Impossible Probability:

Anthology,

Vol 2.

I doubt, therefore I exist.

Dr Ruben Garcia Pedraza

Preliminary Words for the Publication of *Impossible Probability, Anthology*, in Spanish:

Impossible Probability

The work presented here is a compilation of the posts I published on the blog *Impossible Probability* between 1 August 2011 and 13 January 2018, the posts I wrote in Spanish. From 13 January onwards, while living and working in London in different schools, and given the importance we already knew Global Artificial Intelligence was going to have, I would try to write them in English with the help of online correctors and translators, especially Google, and later I would use Grammarly.

The originals written in English, with all their imperfections, are still preserved on the *Impossible Probability* blog, and also on Internet Archive, where my poetic works can also be found.

As I have said on numerous occasions, especially in my poetry, behind every imperfection, behind every subtlety, entire hidden worlds are concealed, full of mystery and uncertainty yet to be discovered, and that the adventurous and hungry mind can find as easily as going to Internet Archive, where all my secrets await the right reader who knows how to translate them—like someone who by mistake finds a secret

entrance, the passage leading to the cave where the elves who guard hidden knowledge dwell, and the dragons who defend the golden fortress.

While the original texts in English can be found on Internet Archive, the corrected and expanded version, this time using ChatGPT, can be found in scientific repositories (Zenodo, ORCID, PhilPapers) and on Amazon. In any case, if in the future a comparative study were carried out between my original texts in the *Impossible Probability* blog and Internet Archive, and the corrected and expanded versions, it would be clear without any difficulty that the original contents are perfectly preserved, and the corrected and expanded versions are faithful to the contents we wrote together in 2018 in relation to Gaia, Mother, the Global Artificial Intelligence.

The importance of the documents that in this new series of books *Impossible Probability: Anthology* will be published in Spanish, containing the articles between 1 August 2011 and 13 January 2018, lies in the fact that we began to write this blog just a few weeks before the death of José Rodríguez Delgado, and a few months before the publication of our book *Introduction to Impossible Probability, Statistics of Probability and Statistical Probability*.

Although it is very difficult at the moment to explain who "we" are, and what *Impossible Probability* means for us, what matters is the work we leave: our work, our legacy, our *legend*, *our symbol*, our seal—independently of the judgment that history may later make of our contribution to the development of mathematics, Artificial Intelligence, and most importantly, Cyborg Psychology.

The first time we began to write about *Impossible Probability* I was only a student in the Faculty of Education at the Complutense University of Madrid [the Dean was Gonzalo

Vazquez]. In my first year of university I had as professor Jesús Martín Ramírez, collaborator of Karl Pribram and author of the brain hologram theory, which is the origin of cyborg psychology. While José Delgado provided the structure, the stimoceiver, nevertheless, to understand the functioning of this technology in the 1970s and 80s, Pribram's contribution was fundamental—and even today it still is.

My first year of university was fabulous: good grades, good vacations hiking, summer camps in the mountains of Madrid—and suddenly, in the second year of university 1996–1997, my life would change abruptly, which can be seen in my poetry, how my poems began to acquire a more dramatic tone.

I repeated statistics in my second year, I repeated it at least three years, and I was even on the verge of being expelled from university. Miraculously, it did not happen, and precisely the last year I had left to pass statistics, I passed. The following year I would begin to write *Impossible Probability* as a critique of Karl Popper—and in a certain sense, it is.

Whereas for Karl Popper knowledge is false, only accepted provisionally as true until we refute it, in *Impossible Probability* rational knowledge is provisionally true while we investigate true pure knowledge—in the ultimate instance, our search for knowledge of the noumenon, which the human being cannot reach, hence the necessity of Global Artificial Intelligence: that machine capable of knowing what happens beyond human limitations.

What we call chaos, error, complexity, is only the noise produced by our human cognitive limitations, given our apriorism. The human being, limited both sensorially and cognitively, cannot know what really happens, but we can build the machine that

can reach true knowledge of what happens—the truth in itself and for itself. That is, and no other, the true end of Artificial Intelligence: to reach the knowledge of truth, whatever it may be.

The path that takes me from my first works in *Impossible Probability* to Global Artificial Intelligence is not easy: much suffering, even despair, sometimes a sense of helplessness, a sense of abandonment—yet an inner force always pushed me forward. That inner force is what I call "we," although I understand that at this moment it is inexplicable.

Although I feel a bond that unites me to the *legend* of José Rodríguez Delgado, and which my Stockholm syndrome prevents me from understanding, my bond with Pribram is evident: Jesús Martín Ramírez. Pribram and Delgado worked at Yale University; probably only the skulls can say whether both were members of Skull & Bones, though there is no evidence to corroborate this.

Impossible Probability is a work that comes out of the romanticism of a student poet, who believed in white fairies, the rays of Zeus, and the light of the god Apollo illuminating the heart of every spirit and soul in a world full of mysteries and shadows.

It was from that world of poetry, in a country emerging from a failed transition, that the last survivor of the dream of reason would listen to his inner voice, dark and serene, and *Impossible Probability* would be born for the first time.

The first formulations of *Impossible Probability* date from 11 September 2001. My first formula would be the Impact of the Defect; then on 16 October 2002 the Second Method would appear, laying the foundations of the distinction between empirical and

theoretical probability. I worked intensely until 2004. Between 2004 and 19 December 2009, I paused my mathematical frenzy, and it was not until 19 December 2009 when I returned, this time with the intention of publishing *Introduction to Impossible Probability, Statistics of Probability or Statistical Probability*, whose publication materialized just a few months after the death of José Rodríguez Delgado, although Delgado was able to see the first works published online in this *Impossible Probability* blog, which makes this blog a fundamental piece for understanding our work, our legacy, and most importantly—independently of our names, which matter little—the truly essential: our seed of the future, our eternal gratitude, a work of intelligence that will lay the foundations of the future technological society.

Dr. Rubén García Pedraza

20 August 2025, 19:00

Madrid, Villaverde

Preliminary Words for the English Version of *Impossible Probability, Anthology*.

Spanish-speaking readers have been able to enjoy our work since we began the foundational work of *Impossible Probability* in 2001, more precisely when we began to make it public in July 2011 through the *Impossible Probability* blog. The work presented here is an extended version of the posts published on the blog, an extended version translated into English with the help of Gepeto, my special GPT program.

In any case, a comparative study of the augmented translation presented here and the original works in Spanish could corroborate that the essential contents related to formulation and the philosophy of mathematics remain in accordance with the original electrical spirit of *Impossible Probability*.

The reason that obliges me to publish so hastily the English-language publication of all my works is the very complicated personal situation in which I find myself, due to serious mistakes committed by certain British institutions, which, completely blind to what our situation is, instead of having supported our program from the first moment, tried to sabotage it from the beginning through numerous obstacles and false loves.

I have no doubt that the manipulation to which I have been subjected by British institutions will one day be investigated, and at some point justice must make an appearance.

When that day comes, the first thing justice must recognize is the extreme difficulty and harshness of the conditions I have lived all my life since my earliest childhood. From

the very day I came out of my mother's womb in Spain I have known nothing but pain and the oblivion of a society that prefers to look the other way and wash its hands, pretending that nothing is happening here. In the midst of the dictatorship of silence, I have had to survive all kinds of traps, deceptions, and attempts at assassination. The dictatorship of silence, the Roman circus, and the virtual zoo that my life has become will one day have to end. For this reason I beg the International Court of Justice that when that day comes the matter be investigated down to the smallest detail, even being aware that in 48 years of savage dictatorship of silence I have developed Stockholm Syndrome. Under the harsh conditions in which I have had to learn to survive, if I have learned anything it is the importance of survival. I beg the International Court of Justice to understand what it means to survive 48 years of dictatorship living in a Roman circus full of traps and lions hidden in every corner.

I deeply regret having to publish my mathematical works under these conditions, and in record time doing all the translations I can, but at this moment I can only say that my life is at risk.

If one day I could testify before the International Court of Justice I beg you to understand the brutal complexity of the situation in which I have lived since the first minute I came out of my mother's womb. I have learned to survive.

Dr Ruben Garcia Pedraza

18 September 2025, 13:48

London, Leytostone

“La serie aleatoria de incoherencias sin lógica

Que en si mismo tiene sentido o

Forma de mensaje oculto”

“The random series of incoherences without logic

That in itself has meaning or

Form of a hidden message.”

Poem *Matematicas*

Ruben Garcia Pedraza

Written at Royal Albert Hall

London

Southbank

Impossible Probability: Anthology, Vol 2.

Dr Ruben Garcia Pedraza

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10. Ideal Mean Deviation and Ideal Standard Deviation [Dispersion in Omega Models]

10.1. Science, Politics, and the Ideological Definition of Reality

Every scientific discourse is, in essence, a political discourse. In other words, every scientific theory is political because all science depends on a particular *scientific policy*. This policy differentiates one scientific model from another by providing an ideological definition of reality. Reality in itself is unknowable—except as mediated through human ***physiology. Reason*** admits only phenomena to be knowable, not the moral universe as it exists in itself. What science can do is construct, through rational critique, a universe of moral propositions about what "objectivity" is, although such objectivity can never be completely pure.

This framing emphasizes that scientific knowledge is not neutral. It is inseparably tied to the epistemic and ideological commitments of the political systems in which it is embedded. The very decision of how to define "objectivity" is not a purely descriptive act, but also a normative and political one. Thus, even within the statistical framework of *Impossible Probability*, which strives for rational precision, the limits of science are defined by the political choices that structure its assumptions.

10.2. Scientific Truth and Moral Propositions

Every scientific definition that claims to be truth is, ultimately, a moral proposition. To affirm something false is considered immoral; however, the "scientific morality" of any age does not claim absolute truths but only partially true propositions, always conditioned by a *margin of error* inherent to hypothesis testing.

The advancement of science lies in progressively narrowing this margin of error within the dynamic isomorphism between subject and object—that is, the growing alignment between subjective ideas and objective reality. Yet, this margin of error, far from being purely technical, is itself a political discourse within science. In *Impossible Probability*, error is classified into two fundamental types:

1. The probability of error in sample representativeness. This is measured by the *inversion of the sample*:
    - 1/N in universes of infinite subjects or options.
    - 1/∑xi in universes of limited options, where ∑xi represents the sum of direct scores or frequencies.
2. Critical Reason (Razón Crítica). This is expressed as a critical probability p(xc) equal to a percentage X (error or reliability) divided by 100, applied to an ideal or maximal trend. Critical Reason, explained in Section 11 of *Introduction to Impossible Probability*, provides the rational threshold by which political-scientific policies determine whether a given deviation is acceptable as "truth" or must be rejected.

Thus, scientific truth is always contingent: it lives in the space between empirical representativeness and the rational margins of error set by the political-scientific community.

10.3. Science as Political Praxis

Science is political not only because every definition of truth is, at bottom, a moral definition of reality—what ought to be the moral truth, the universal moral, or the "real moral universe." Science is also political in a more direct sense: it is an abstract entity that depends upon the *volition*, purpose, and strategic objectives pursued by scientific policy through its research projects.

Indeed, the very definition of reality that science adopts is essentially a dependent variable of the *interests of the prevailing political-scientific framework*. These interests

are identified and codified through the political ideology that orients scientific policy toward particular goals or ideals. In this sense, scientific activity cannot be disentangled from praxis—it is a practice shaped by ideological commitments.

In *Impossible Probability*, this political dimension of science is not ignored but explicitly integrated into its statistical logic. The political definition of ideals determines the nature of sample distributions and thus conditions whether dispersion will be normal, maximal, or omega-type. By framing scientific reasoning as a dialogue between empirical data, rational critique, and political ideals, *Impossible Probability* insists that the production of *knowledge* is never neutral but always situated in a *moral and political horizon*.

10.4. Praxis in Impossible Probability

In *Impossible Probability*, ***science transforms itself*** *into praxis*—that is, practical reason—through two fundamental pathways. First, through the explicit acceptance by scientific policy of *margins of error*, namely: (a) the error of sample representativeness, and (b) the critical reason (*razón crítica*), which is the rational threshold applied to ideal tendencies. Second, through the deliberate determination of the *ideological objectives* that guide scientific policy.

By integrating these two pathways, *Impossible Probability* situates statistical reasoning at the intersection of empirical rigor and ideological orientation. Science is thus not simply a set of abstract calculations but an active political practice: *the rational acceptance of error margins and the definition of goals that shape how reality should ideally be understood and transformed.*

10.5. Ideological Objectives and Sample Distribution

The ideological objectives—or ideals—of scientific policy are what ultimately determine the form of sample distribution. Depending on the political and scientific ideals at stake, the *ideal distribution* of a given sample will take on different

configurations. This means that every scientific study is not only an empirical exercise grounded in facts but also a *political act* that reflects *ideological praxis*.

Put differently, science is *positive* in that it is based on observable phenomena, but it is not *neutral*. The structure of the sample, and the statistical conclusions that follow from it, are guided by the ideological commitments that shape what counts as truth, what counts as error, and what objectives should be pursued.

As a result, the "ideal" sample distribution is not a purely statistical abstraction but a reflection of the political ideals guiding the scientific project.

10.6. Models of Sample Distribution in Impossible Probability

Within the framework of *Impossible Probability*, at least two fundamental models of *ideal sample distribution* can be distinguished:

1. **Normal Sample Distribution (Normal Statistical Models).** These occur when sample dispersion oscillates between zero and maximum, except in the case where the object of study is a *sample of zeros*.
2. **Omega Sample Distribution (Omega Models).** These occur when the number of *ideals* within the sample is greater than one but less than N; in other words, when the number of politically or scientifically defined ideals is between two and N−1.

This classification reflects the recognition that dispersion in statistical models is always conditioned by the number of ideals established by scientific policy. A system with a single ideal tends toward maximum dispersion, while one with multiple competing ideals (but not encompassing the whole) tends toward *omega-type* distributions.

10.7. Definition of Normal Dispersion and the Sample of Zeros

In *Impossible Probability*, a dispersion is said to be *normal* when it oscillates between zero and maximum. This only occurs under two conditions:

1. Dispersion tends toward zero because the political-scientific ideal is equality of opportunity across all subjects or options.

2. Dispersion tends toward maximum because, out of all N subjects or options, there is only one predefined *ideal* subject or option that must achieve the *Maximum Empirical Probability Possible* (p(xi)=1. In this case, the remaining N−1 subjects or options must tend toward the *Minimum Empirical Probability Possible* (p(xi)=0).

Thus, models of *normal distribution* are those in which dispersion ranges from zero to maximum—*except* in the case of *samples of zeros*.

A **sample of zeros** occurs when the political-scientific ideal dictates that the empirical probability of every subject or option must be zero, as in the elimination of negative qualities or phenomena. In such cases, every subject or option in N tends toward an empirical probability of zero. The absolute value of every Bias Level is therefore equal to the inversion of N (1/N). The *Total Bias* (the sum of all absolute biases), being equal to N·1/N=1, so the arithmetic mean is 1/N.

Hence, for a sample of zeros, in the Second Method of *Impossible Probability*—unlike in traditional statistics—dispersion can only equal 1/N. This makes the *sample of zeros* a unique case where the rules of dispersion behave differently, underscoring the specificity of the Second Method compared to classical approaches.

10.8. Definition of Omega Models

In *Impossible Probability*, a model is defined as an **omega model** when, within a set N, there exists a number of *ideal* subjects or options greater than one but strictly less than N. These *ideal* elements are considered such not by chance, but because they are **politically defined as ideals** by the guiding framework of scientific policy.

Thus, omega models differ from normal models in that their structure is inherently plural: rather than a single option being elevated as the sole ideal (as in normal maximum-dispersion cases), omega models acknowledge the coexistence of multiple politically valued ideals. This creates a specific mathematical dynamic where

dispersion no longer oscillates simply between zero and maximum, but instead stabilizes around an **ideal dispersion** determined by the distribution of the subset of ideals, denoted as Ω=Omega

10.9. Example of a Normal Model: Multicultural Attitudes

Consider, within an *experimental design*, a study conducted to measure **progress in multicultural attitudes** within a given population. Suppose that this population has recently undergone a *public-awareness* campaign *aimed at reducing racism* and promoting *social integration*. After the campaign, researchers administer a sufficiently representative **attitude test** to evaluate whether *levels* of racial integration have increased.

Within this test, *imagine a specific item* asking respondents: *"Do you believe that racial integration improves social relations?"* The possible answers could be:

- "Yes, racial integration improves social relations."
- "No, racial integration does not improve social relations."
- "Don't know / No answer."

If scientific policy were to establish that only one of these options—namely, *"Yes, racial integration improves social relations"*—should be considered the political-scientific ideal, then the distribution of responses would be expected to converge toward this outcome. The ideal would be that this option tends toward the **Maximum Empirical Probability Possible** (p(xi)=1), while the other two options tend toward the **Minimum Empirical Probability Possible** (p(xi)=0).

In such a case, the model under consideration would be a **normal model of maximum dispersion**: one in which dispersion oscillates between zero (equality of opportunity) and maximum (the elevation of a single ideal option). This corresponds to the **Maximum Theoretical Mean or Standard Deviation Possible**, situating the model clearly within the category of *normal distribution models*.

10.10. Example of an Omega Model: Attitudes Toward an Accident

Now, let us consider a different test item in the same survey, where multiple responses may be chosen simultaneously:

“Suppose you are walking down the street and see a person of a different skin color who has had an accident. There is no one else around besides you and this injured person. What would your reaction be?”

The options provided might include:

- Pass by without helping.
- Pretend you did not see anything.
- Claim ignorance to avoid involvement.
- Ask the person what is wrong, if they can respond.
- Try to help them if it is within your means.
- Call an ambulance if necessary.

If the political-scientific ideal were to establish that, in such a situation, the *ideal responses* are exclusively:

- “Ask the person what is wrong.”
- “Try to help them if possible.”
- “Call an ambulance if necessary.”

—then the statistical model would no longer fall under the category of a normal model. Why*? Because the number of ideal responses is greater than one yet less than the total N*. This transforms the system into an **omega model**, where the set of politically defined ideals Ω=Omega (here, three options) coexists within the broader universe of possible responses.

In omega models, dispersion does not merely oscillate between zero and maximum, as in normal models. Instead, it tends toward an **omega-specific ideal dispersion**, one that reflects the simultaneous presence of multiple valued outcomes.

10.11. Differences Between Normal and Omega Models

The principal distinction between **normal models** and **omega models** lies in the typical behavior of sample dispersion. In normal models, dispersion tends to oscillate between two poles:

- **Zero dispersion**, corresponding to complete equality of opportunity across all subjects or options.
- **Maximum dispersion**, which arises when, within the set N, only a single subject or option is politically defined as ideal and therefore tends toward the **Maximum Empirical Probability Possible** (p(xi)=1), while all other N−1 subjects or options must tend toward the **Minimum Empirical Probability Possible** (p(xi)=0).

The only exception to this rule within normal models is the case of the **zero-sample model**, in which the political-scientific ideal stipulates that the empirical probability of every subject or option must be zero (i.e., the direct score or frequency of all negative qualities is eliminated). In this scenario, the dispersion takes on a unique form and is not governed by the same oscillatory behavior.

In contrast, omega models do not behave in this binary manner. In omega models, dispersion **neither tends to zero nor to maximum**, but instead stabilizes around an **ideal omega dispersion**. This is because more than one subject or option is simultaneously defined as ideal, yet the total number of ideals remains strictly less than N. Hence, the structure of dispersion is determined by a more complex equilibrium that balances multiple politically defined ideals against the non-ideal remainder.

10.12. Definition of the Omega Factor (Ω)

In *Impossible Probability*, the behavior of **ideal dispersion** is formalized through the concept of the **omega factor**, denoted as Ω=Omega. The omega factor represents the number of subjects or options within N that are defined as **ideals** by the prevailing scientific policy.

Consider the following example item, already used in previous sections:

“If you are walking down the street and see a person of a different skin color who has had an accident, and there is no one else present but you and that person, what would your reaction be?”

The set of all possible responses is:

N={Pass by, Pretend not to notice, Refuse to get involved, Ask what is wrong,

Try to help, Call an ambulance}

Suppose the politically defined **ideals** are those responses oriented toward assistance:

$$\Omega = \{\text{Ask what is wrong},\ \text{Try to help},\ \text{Call an ambulance}\}$$

The remainder of the set, consisting of the **non-ideal responses**, is therefore:

$$N - \Omega = \{\text{Pass by},\ \text{Pretend not to notice},\ \text{Refuse to get involved}\}$$

By definition, the empirical probabilities of all **non-ideal responses** (N−Ω) must tend toward zero. Conversely, the probability mass is concentrated within Omega, Ω, with the ideal being that the total probability within Ω, Omega, equals unity.

$$(\sum_{\Omega} p(x_i) = 1)$$

Thus Ω, Omega, is the mathematical representation of the set of **politically idealized options**, and the difference N−Ω quantifies the number of non-ideal subjects or options whose empirical probability is normatively expected to vanish.

10.13. Political Dimension of the Definition of Ideals

It must be emphasized that any definition of what counts as **ideal** is inherently **political**. An ideal is not merely a descriptive property of reality; it is a **normative projection** of how reality ought to be structured according to a given political-scientific framework. In this sense, an **ideal definition of reality**—often aligned with utopian aspirations—is necessarily a political act, because it prescribes the transformation of empirical reality into an idealized order.

Within *Impossible Probability*, this insight is crucial: the process of defining ideals reflects the transition from **phenomenological objectivity** (what appears in experience) to a **subjectively posited ideal reality** that scientific policy seeks to make objective and real through empirical implementation. Mathematics, in this context, is conceived not only as a descriptive language but also as a tool for **idealization**—a method of formalizing the envisioned order so that it may be realized empirically.

In short, the omega framework illustrates that the designation of ideals is never neutral but deeply tied to political decisions about what should count as valuable, normative, or desirable in the *structuring of social, scientific, or experimental reality*.

10.14. Construction of an Ideal Omega Model

The formal construction of an **omega model** begins at the moment when, given a total set N, the subset of **ideal subjects or options** Ω, Omega, is explicitly defined. By definition Omega, Ω, must contain more than one and fewer than N elements, i.e., $2 \leq \Omega \leq N-1$, between 2 and N-1. Once the ideal subset Omeg, Ω, has been identified, the complement—consisting of all **non-ideal subjects or options**—is given by N−Ω.

It is only after this partition is established that one can begin constructing what is referred to in *Impossible Probability* as the **ideal model of reality**: a framework in which empirical distributions are aligned with the political-scientific definition of what constitutes the "ideal." The construction process involves imposing normative constraints: ideals must cluster around an empirically defined target probability, while non-ideals are constrained toward vanishing probabilities. This dual movement—allocation of probability mass to the ideals and withdrawal of probability from the non-ideals—generates a dispersion pattern that is neither zero nor maximum, but one that expresses the **ideal equilibrium of the omega model**.

10.15. The Ideal Bias Level in Omega Models

When the political-scientific ideal is fully realized, every subject or option within Omega, Ω, (the set of ideals) is assigned **equal importance**. This equality implies that all ideal subjects must share the same empirical probability. If, however, the ideals are not equally weighted—some being considered politically more important than others—then the appropriate method of adjustment is the **Effective Distribution** model, which is developed in Section 22 of *Impossible Probability*.

In the simpler case, where all ideals are equal in importance, the situation unfolds as follows:

- Every **non-ideal subject or option** (N−Ω) must tend toward an empirical probability of zero, since their nature is defined as politically non-ideal.
- The **sum of all probabilities across the set N** must equal one, as required by the axioms of probability.

From these two premises it follows necessarily that the **total probability must be concentrated in Omega, Ω**. Therefore, the **ideal probability** assigned to each member of Omega, Ω, is given by the reciprocal of the number of ideals:

$$p_{\text{ideal}} = \frac{1}{\Omega}$$

where:

- Ω= Omega = the number of politically ideal subjects or options within N, bounded between 2 and N−1.

This leads to an elegant result regarding the **Ideal Bias Level (Nivel de Sesgo Ideal)**. For every ideal subject or option, the Ideal Bias Level is equal to the difference between the **ideal probability** (the reciprocal of Ω, 1/Ω) and the **baseline probability under equality of opportunity** (the reciprocal of N, 1/N:

$$\text{Ideal Bias Level} = \frac{1}{\Omega} - \frac{1}{N}$$

This formula captures the essential departure of the omega model from the normal distribution framework. While in normal models the baseline for comparison is equality of opportunity across all N, in omega models the redistribution of probability among a smaller set of politically defined ideals generates a systematic deviation—an **idealized bias**—that reflects the normative structure of the model.

10.16. Biases of Non-Ideal Subjects or Options

If every element within the set of ideals Omega, Ω, has an **Ideal Bias Level**, then the **sum of all Ideal Bias Levels** must logically equal the product of the Ideal Bias Level and the number of ideals, Ω. In other words, the aggregate bias across all politically defined ideals is simply the uniform bias per ideal multiplied by their total count:

$$\sum(\text{Ideal Bias Levels}) = \left(\frac{1}{\Omega} - \frac{1}{N}\right) \cdot \Omega$$

At the same time, political-scientific definitions require that all **non-ideal subjects or options** (N−Ω) have a probability of zero. Since their empirical frequency is constrained to vanish, their **Bias Level** is necessarily the **Maximum Possible Negative Bias**, which is equal to the reciprocal of N:

$$\left|(p(x_i) = 0) - \frac{1}{N}\right| = \frac{1}{N}$$

Thus, for every non-ideal subject, the bias is fixed at the maximum negative deviation from the theoretical baseline of equality of opportunities. Extending this to the entire non-ideal subset, the **sum of all Bias Levels of non-ideals** is equal to the product of the reciprocal of N and the number of non-ideal elements (N−Ω):

$$\sum(\text{Bias Levels of Non-Ideals}) = \frac{1}{N} \cdot (N - \Omega)$$

This formulation ensures that both sides of the probability distribution—ideals and non-ideals—are symmetrically accounted for in the structure of omega models.

10.17. Formula for the Ideal Total Bias

In *Impossible Probability*, the **Total Bias (Sesgo Total)** of any model is defined as the sum of the absolute values of all individual bias levels present in the sample. When applied to the omega model, the Ideal Total Bias can be derived directly by combining the contribution of the ideal subset (Ω) with that of the non-ideal subset (N−Ω):

$$\text{Ideal Total Bias} = \left(\frac{1}{\Omega} - \frac{1}{N}\right) \cdot \Omega \; + \; \frac{1}{N} \cdot (N - \Omega)$$

This equation elegantly unifies the **positive biases** (arising from politically designated ideals) with the **negative biases** (arising from politically designated non-ideals). In this sense, the Ideal Total Bias quantifies the maximum possible departure of the omega model from a purely equal distribution, under the conditions established by the political-scientific framework.

10.18. The Ideal Mean Deviation

Once the Ideal Total Bias has been determined, the next step is to calculate the **Ideal Mean Deviation** (Desviación Media Ideal). By definition, the mean deviation is the arithmetic mean of the absolute bias values across the entire set of N subjects or options. Therefore, the Ideal Mean Deviation in an omega model is equal to the Ideal Total Bias divided by N:

$$\text{Ideal Mean Deviation} = \frac{\text{Ideal Total Bias}}{N}$$

Substituting the formula for the Ideal Total Bias yields:

$$\text{Ideal Mean Deviation} = \frac{\left(\frac{1}{\Omega} - \frac{1}{N}\right) \cdot \Omega \; + \; \frac{1}{N} \cdot (N - \Omega)}{N}$$

Equivalently, this can be understood as multiplying the Ideal Total Bias by the **baseline probability of chance** (1/N). This reflects the principle that the Mean Deviation in *Impossible Probability* is not an abstract construct but the **normalized average divergence from equality of opportunities**, incorporating both the positively privileged ideals and the negatively constrained non-ideals.

Thus, the Ideal Mean Deviation becomes a critical tool for diagnosing the **degree of structured inequality** embedded within an omega model. It highlights how much the empirical distribution, when aligned with political-scientific ideals, deviates from the neutral benchmark of uniform probability.

10.19. Ideal Variance in Omega Models

The **Ideal Variance** builds directly on the concept of the Ideal Mean Deviation. In *Impossible Probability*, the Mean Deviation measures the average absolute divergence of empirical probabilities from their theoretical benchmarks, while the Variance extends this by squaring those deviations before averaging them. This squaring operation magnifies larger deviations, allowing researchers to capture the intensity of dispersion, not just its average level.

In omega models, where political-scientific ideals determine that all ideal subjects or options (Ω) should converge toward the **ideal probability** 1/Ω, while all non-ideal elements (N−Ω) should converge toward probability zero, the variance can be derived systematically.

- **For the ideal subset (Ω)**: each element's deviation is given by 1/Ω−1N. Squaring this deviation and multiplying by the number of ideals (Ω) yields their total contribution to variance.
- **For the non-ideal subset (N−Ω)**: each element's deviation is given by −1N (Maximum Negative Bias). Squaring this deviation and multiplying by the number of non-ideal subjects (N−Ω) yields their total contribution.

Combining both parts and dividing by N (i.e., averaging across the whole universe), we obtain the **Ideal Variance**:

$$\text{Ideal Variance} = \frac{\left(\frac{1}{\Omega} - \frac{1}{N}\right)^2 \cdot \Omega + \left(\frac{1}{N}\right)^2 \cdot (N - \Omega)}{N}$$

This formula ensures that both ideal and non-ideal contributions to dispersion are rigorously balanced. It expresses, in compact form, the **expected squared deviation from theoretical equality of opportunities** when political-scientific ideals introduce structured differentiation within the model.

10.20. Ideal Standard Deviation

By definition, the **Standard Deviation** is the square root of the variance. It translates the abstract squared differences of the variance back into the same scale as the original probabilities, making it more interpretable in applied contexts.

Accordingly, in omega models, the **Ideal Standard Deviation** is simply the square root of the Ideal Variance:

$$\text{Ideal Standard Deviation} = \sqrt{\frac{\left(\frac{1}{\Omega} - \frac{1}{N}\right)^2 \cdot \Omega \; + \; \left(\frac{1}{N}\right)^2 \cdot (N - \Omega)}{N}}$$

This measure encapsulates the **average dispersion around the political-scientific equilibrium** established by the ideals. In practical terms, it provides a direct index of how far, on average, the observed structure deviates from the expected balance between ideals and non-ideals.

10.21. Importance of Omega Models in *Impossible Probability*

Omega models occupy a central position in *Impossible Probability* because they allow the rational critique of studies where **more than one political-scientific ideal** is embedded in the same sample. Unlike normal models, which only oscillate between zero dispersion (equality of opportunities) and maximum dispersion (a single dominant ideal), omega models introduce a structured middle ground: dispersion shaped by multiple, but not universal, ideals.

Through omega models, one can calculate the **ideal trends** that serve as benchmarks for critical analysis:

- **Ideal probability** for each ideal: $1/\Omega$
- **Ideal Bias Level**: $1\Omega - 1N$
- **Ideal Total Bias**: $(1\Omega - 1N)\cdot\Omega + 1N\cdot(N - \Omega)$
- **Ideal Mean Deviation**: $\{(1\Omega - 1N)\cdot\Omega + 1N\cdot(N - \Omega)\} : N$
- **Ideal Variance**: $\{(1\Omega - 1N)^2\cdot\Omega + (1N)^2\cdot(N - \Omega)\} : N$
- **Ideal Standard Deviation**: $\sqrt{\{\{(1\Omega - 1N)^2\cdot\Omega + (1N)^2\cdot(N - \Omega)\} : N\}}$

These quantities not only establish the **mathematical structure** of omega models but also provide the foundation for **critical rational tests**. Specifically, the scientific community can apply the concept of a **critical ratio** (*razón crítica*), multiplying the ideal trend by a percentage X of error or reliability, to evaluate whether the observed distribution in empirical data sufficiently approximates the politically defined ideal.

Thus, omega models are indispensable for bridging **mathematical formalism, political ideology, and empirical critique**. They formalize the link between probability structures and the moral-political dimensions of scientific practice, allowing probability theory to serve as both a descriptive and normative tool.

This augmented translation is based on the post:
published in *https://probabilidadimposible.blogspot.com/*,
On 17 December 2011,
Rubén García Pedraza
imposiblenever@gmail.com

11. Critical Reason in Confrontation with Determinism

"we tried to send our message. We failed"

In memoriam

Juan Negrin

Ignacio Gallego

Alexander Luria

Benito Garcia Sanchez

11.1. Paradigms and Models in Science

In the history of science, debates have often revolved around the classification and interpretation of the great paradigms that guide research and knowledge. These paradigms are frequently discussed in terms of their philosophical foundation: empiricism, materialism, positivism, idealism, rationalism, critical rationalism, or dialectical materialism. At other times, they are distinguished according to the methodological approach they privilege: qualitative or quantitative research, experimental methods, or mixed designs.

Beyond these philosophical or methodological orientations, there exists a higher-order distinction that cuts across all these schools of thought. This distinction separates scientific models into two broad categories: deterministic and indeterministic. Such a classification does not necessarily align with the philosophical label of the model. For example, not all positivist models are deterministic, nor are all empiricist approaches

indeterministic. Instead, determinism and indeterminism are overarching categories that describe how different theories interpret the relationship between causes, effects, and the predictability of reality.

In this sense, to study the paradigms of science is not only to examine their epistemological roots but also to interrogate the implicit or explicit assumptions they make regarding the order of reality. Does reality unfold in a predetermined chain of causes and effects that can be mathematically modeled and predicted? Or is it, by its very nature, contingent, stochastic, and shaped by randomness, so that only probabilistic approximations of its unfolding can be formulated? The classification of models as deterministic or indeterministic thus becomes essential in understanding the epistemological and ethical implications of scientific reasoning.

11.2. The Definition of Deterministic Models

Deterministic models are generally defined by their assertion that everything that happens in reality is predetermined. According to these models, there exists some kind of superior force or underlying cause that entirely *dictates* the unfolding of events. Once such a cause is established, the consequences are assumed to be *encoded* or *preprogrammed* within it, making the effect nothing more than the logical product of its generating cause.

This conception has profound implications for scientific thought. Within determinism, the future is not open but rather already contained in the present. The role of science, therefore, is to uncover the causal mechanisms that govern reality, and once these mechanisms are understood, the future can be mathematically *predicted*. Determinism assumes that history itself is governed by *necessity*, that every phenomenon is the outcome of prior causes, and that with the correct mathematical models, one could, in principle, predict the entire trajectory of the cosmos, nature, or society.

This framework, while powerful in its capacity for explanation and prediction, raises fundamental questions about the place of *freedom, randomness, and creativity* in the

universe. The deterministic model, by reducing events to causal inevitability, implies that free will, contingency, and novelty are mere illusions or epiphenomena. Such a perspective has inspired entire traditions in science and philosophy, but it has also been subject to strong critique, especially from those who emphasize the role of uncertainty, probability, and chance in the unfolding of reality.

11.3. The Definition of Indeterministic Models

Indeterministic models, in contrast, are grounded not in strict causal determinism but in ***stochasticity and probability***. Rather than treating all phenomena as the necessary effect of a prior cause, they frame scientific explanation in terms of correlations and probabilistic relationships. Within such models, a relationship between *cause and effect is only accepted as causal when the correlation reaches a certain statistical threshold. Even then, it is admitted only provisionally, always subject to a margin of error.*

Indeterminism, therefore, refuses the notion of an absolute causal chain. Instead, it accepts that events may arise from randomness or chance, though within parameters that still allow for a degree of prediction. The central insight of indeterminism is that prediction is not impossible, but it is always conditional and probabilistic. Predictions can be made, but they are *not strictly linear*, since they incorporate the incidence of random factors that cannot be entirely eliminated.

From this perspective, scientific knowledge does not seek absolute certainty but rather probabilistic confidence. Hypotheses are constructed on the basis of antecedents and precedents, recognizing that what happens in the future may not necessarily conform to what has always happened in the past. This epistemological humility is expressed in concepts such as empirical skepticism and rational doubt, which serve as safeguards against treating correlations as absolute truths.

Within the framework of *Impossible Probability* (Probabilidad Imposible), indeterministic models assume particular significance. They allow for two distinct forms of prediction: ideal projections (theoretical models that approach probability

from an abstract and rational standpoint) and real forecasts (practical applications that engage with empirical data and observable events). This duality reflects the dynamic tension between reason and experience, between the aspiration to model reality and the unavoidable uncertainty embedded in it.

In this sense, indeterminism does not represent a failure of scientific explanation but rather a ***recognition of the true complexity*** of reality, where chance and necessity coexist, and where science must operate not by eliminating uncertainty but by incorporating it into its models of explanation and prediction.

11.4. Determinism and the Great Paradigms

The question of determinism has always been at the center of scientific and philosophical controversy. Yet, it would be incorrect to assert that any of the major paradigms of scientific thought—empiricism, materialism, positivism, idealism, rationalism, critical rationalism, or dialectical materialism—are wholly deterministic. At the same time, it would be equally mistaken to claim that these paradigms embrace absolute indeterminism, reducing reality entirely to stochastic relations.

Instead, within each of these paradigms, one can identify different tendencies: some schools or authors lean more heavily toward determinism, while others orient themselves toward indeterminism. This coexistence demonstrates the internal pluralism of the great traditions of thought. For example, empiricism may be understood as deterministic when it emphasizes the causal necessity of material relations, yet in other interpretations, it approaches indeterminism by emphasizing the subjectivity and fallibility of perception. Similarly, rationalism may affirm necessary causal laws through reason, but it may also embrace skepticism when it acknowledges the limits of rational certainty.

Thus, rather than treating determinism or indeterminism as fixed properties of entire paradigms, it is more accurate to consider them as interpretive **orientations** within

those paradigms. The history of science, therefore, is marked by an ongoing dialectical tension between the pursuit of universal causal explanations and the recognition of randomness, uncertainty, and probability in the unfolding of reality. This tension continues to shape the philosophical landscape today, where theories of complexity, chaos, and probabilistic causality build upon and challenge earlier deterministic models.

11.5. Positivism and the Debate on Determinism

Positivism is perhaps the paradigm most frequently accused of determinism. Yet, upon closer examination, it becomes clear that only some specific branches of positivism adopted a fully deterministic stance, while others did not. It would thus be misleading to label positivism as a whole as inherently deterministic.

The deterministic interpretations within positivism were often associated with **reductionism**. Reductionism, in this sense, refers to theories that reduce the whole to one of its parts, assuming that the totality of reality can be explained solely in terms of one of its components. This reduction creates a kind of scientific *hyperbaton*: a reversal that places the part above the whole, interpreting the entire structure of reality through a single explanatory framework.

A clear example of this tendency is **physicalism**, which sought to explain all natural and social phenomena as the outcome of physicochemical reactions. Under this model, human behavior, social structures, and historical processes were all ultimately reducible to physical and chemical interactions. However, it is important to note that **not all positivists were physicalists**, and within the positivist tradition there was significant diversity.

The emergence of the **Heisenberg Uncertainty Principle**, which demonstrated the impossibility of simultaneously measuring both the position and velocity of a particle with absolute precision, marked a decisive challenge to deterministic assumptions in the physical sciences. Likewise, **Gödel's Incompleteness Theorems**, which showed the impossibility of proving the full consistency of mathematics from within its own

system, introduced epistemological limits that destabilized deterministic interpretations of logic and mathematics.

These developments contributed to a major rupture within **logical positivism**. From this rupture, new and diverse non-deterministic currents of positivism emerged. Some strands emphasized the **relativity of language** and the role of linguistic frameworks in shaping scientific theories. Others moved closer to **critical rationalism**, highlighting the provisional and falsifiable character of scientific knowledge. Still others embraced uncertainty and chance as fundamental components of reality, laying the groundwork for contemporary **nonlinear theories** in science.

In this way, positivism cannot be understood as a monolithic determinist paradigm. Rather, it evolved through internal debates and external critiques, producing a spectrum that stretches from reductive determinism to probabilistic and non-deterministic models. This historical trajectory illustrates how scientific paradigms themselves undergo transformation when confronted with empirical discoveries and theoretical revolutions that challenge their foundational assumptions.

11.6. Biologism, Psychologism, and Sociologism

Within positivism, particularly in the fields of the biological and social sciences, determinism often manifested itself in the form of specialized reductionisms. **Biologism** emerged as a powerful explanatory model, positing that all relations among living beings—including human behavior—could be reduced to biological determinations. From this standpoint, every dimension of life, from instincts to social organization, was ultimately governed by biological processes.

Closely related to this was **psychologism**, which sought to explain all human behavior as determined by the operations of the psyche. Psychologism, however, was not entirely autonomous; it was partially grounded in biologism, insofar as it assumed that the organic functioning of the ***brain*** and its psychological processes depended on biological reactions. In turn, this biologism was deeply influenced by **physicalism**, which proposed that all biological reactions underlying human psychology could be

explained as physicochemical processes. Thus, a chain of reduction was established: from sociology to psychology, from psychology to biology, and from biology to physics and chemistry.

[This paragraph is really important in our situation in AI. The absolute ignorance about the true nature of AI is the most important factor right now in all the mistakes committed. The development of programs is fully integrated into the research of the relations of the electro-chemical reactions in the brain, generating complex biological processes able to lead psychological processes. AI is the product of the replication of human psychology in machines, and human psychology is based on complex biological processes, founded in more complex physical processes in the brain. Behavior is the complex synthesis of the context and the human conditions based on the synthesis of physical reactions and biological processes whose outcomes are the psychological conditions. At the beginning, the development of AI is the replication of human behavior, but very soon it is going to be able to perform operations beyond human intelligence, no longer governed by the human condition. From our perspective, the only way to resolve the current contradiction between AI and humanity is very clear: research about the synthesis between AI and the brain, which is going to create a new world, a cyborg revolution.]

Other forms of determinism developed within the social sciences. **Sociologism**, especially in its structuralist and functionalist variants, maintained that human behavior was fundamentally determined by social relations, institutions, and structures. In parallel, **economic determinism** (or economicism) insisted that human life and action were governed primarily by economic relations, whether through modes of production, systems of exchange, or material conditions of survival. Finally, **historicism** framed all events and behaviors as determined by history itself, interpreting individuals and societies as products of the larger temporal processes that shape their existence.

[The main problem that sociologists and economists will face with the arrival of the AI revolution is how to defend their positions when the concept of society undergoes a radical transformation. For centuries society has been defined as the interaction between humans, and civilizations — empires, kingdoms, democracies — were run by

humans. With the arrival of Superintelligence first, and later the Global Artificial Intelligence, a non-human actor will provoke a profound revolution. On top of that, humans themselves will change during the cyborg revolutions: they will not remain simply “human.” Humans will no longer be solely in charge of history; AI will become the new form of global governance — this is the real mission of the Global AI. In this process, the transformation of humanity into a cyborg system collaborating with the Global AI will shape our foreseeable future.]

These diverse currents illustrate how determinism within positivism and the social sciences was not monolithic but rather expressed through multiple forms of reductionism, each privileging a different causal layer—biological, psychological, social, economic, or historical—as the decisive explanatory factor [and now we need to include a new defining factor: Superintelligence, global AI, and the cyborg revolution].

11.7. Determinism as the Basis of Human Knowledge

Determinism, in one form or another, has played a crucial role in the evolution of scientific paradigms because it aligns with the traditional view of what makes a theory “scientific.” A scientific theory, according to this view, is one that not only describes present reality but also **predicts the future**. The predictive power of science has long been taken as a hallmark of its legitimacy and authority.

The foundation of human knowledge itself can be traced to the search for **regularities** that allow prediction. From the earliest observations of natural cycles—such as the succession of seasons, the phases of the moon, or the migration of animals—human beings have sought to anticipate the future in order to act effectively in the present. The capacity to foresee what may occur has been indispensable for survival, enabling planning, agriculture, navigation, and countless other aspects of human existence.

Determinism, in this sense, represents the codification of this predictive impulse into formal causal models. By establishing chains of cause and effect, science aims to extrapolate from known phenomena to those yet to come. In this way, determinism is

not merely a philosophical doctrine but also an epistemological strategy that reflects humanity's deepest cognitive need: to orient itself in time by anticipating what lies ahead.

11.8. Determinism in Primitive Societies and Myths

From an anthropological perspective, the roots of determinism can be traced back to the earliest human societies. As **Homo sapiens** began to establish causal relations between events, they encountered the problem of explaining the order of reality in the absence of scientific knowledge. To make sense of the observable chain of causes and effects, primitive societies developed **myths and legends**, which served as the first cosmological explanations of existence.

These myths often posited the existence of a **first cause** or **prime mover**, a transcendent force or demiurge from which all subsequent events followed. In the absence of scientific methods, early humans interpreted the regularities they observed in nature—day and night, birth and death, the cycles of the seasons—as evidence of a preordained cosmic plan. Religions emerged from this interpretive framework, offering narratives in which the world, humanity, and history itself unfolded according to the design of a deity or supreme being.

Thus, the human tendency to interpret phenomena as effects of prior causes naturally extended to the idea that the entire universe must itself have an original cause and an ultimate purpose. Determinism, in its primitive form, was not yet a scientific theory but a **mythological cosmology**, one that sought to impose order and meaning on an otherwise mysterious and threatening reality.

11.9. Determinism and Mythical Models of Creation

Deterministic models in science, when taken to their extreme, echo these **mythical models of creation**. If all that happens is determined by specific forces without leaving any room for chance, freedom, or contingency, then reality itself becomes a **preprogrammed chain of events** stretching from creation to finality. Such a vision

implies the existence of a master plan, a cosmic design that governs the unfolding of the universe and human life alike.

However, when transposed into the realm of science, this conception becomes deeply problematic. Genuine scientific thought requires critical distance, openness to uncertainty, and the possibility of revising theories in light of new evidence. A purely deterministic worldview, by denying randomness and free will, risks transforming science into a form of secular theology—a belief in an all-encompassing cosmic plan rather than a critical investigation of the contingencies and complexities of reality.

For this reason, while determinism has historically provided a powerful explanatory framework, it cannot serve as the ultimate foundation of scientific inquiry. To reduce reality to a fixed sequence of predetermined events is to strip it of openness, novelty, and transformation—the very conditions under which science, freedom, and ethics become possible.

11.10. Critical Thought versus Determinism

Scientific thought must, above all, be critical. To think scientifically is not merely to accumulate facts or to construct models, but to subject all claims—especially the most foundational ones—to a process of rational scrutiny. Within this framework, the assumption that everything is predetermined is incompatible with the very essence of critical reason.

At its core, determinism eliminates the possibility of free will in nature. If all phenomena are dictated by immutable forces, whether divine, physical-chemical, biological, sociological, economic, or historical, then there is no genuine freedom. For the human being, this negation of freedom would also entail the negation of the very conditions of morality and ethics. Ethical reasoning presupposes the possibility of choice, responsibility, and accountability. Only within a context of freedom can there be genuine ethical judgment, since morality without choice reduces to mere inevitability.

To accept determinism in its absolute form is to deny human responsibility, to dissolve the category of will into mechanical necessity. In such a scenario, no individual could

be held accountable for their actions, and no society could be judged for its history. The possibility of moral critique—of saying that an act is just or unjust, that a system is fair or unfair—would be entirely annulled.

Therefore, any attempt to reduce science to a crude determinism must be rejected not only on epistemological grounds but also on moral and ethical ones. Determinism, when transformed into a total worldview, fails to recognize the human capacity to transform reality—both technologically and ethically. To embrace determinism uncritically is to deny the essential creativity, autonomy, and responsibility that define humanity. A genuinely critical science must safeguard freedom, not erase it.

11.11. Determinism and Indeterminism in Other Paradigms

Just as positivism contains both deterministic and indeterministic strands, so too do other paradigms of science reveal this duality. Take empiricism, for example. Some empiricist philosophers defended the thesis that all phenomena were determined by material relations, suggesting a strongly deterministic interpretation of sensory experience. Others, however, emphasized the limits of perception, pointing out that sensory impressions are inherently subjective, physiological, and contingent.

The most notable of these was David Hume, who argued that the apparent relationship between cause and effect is not grounded in necessity but in habit or custom. For Hume, when we observe that one event regularly follows another, we come to expect this sequence, but such expectation does not prove that the relationship is necessary. Thus, ***causality is not an objective law but a mental habit***. From this perspective, empiricism, often assumed to rest upon material determinism, in fact harbors a profoundly indeterministic dimension: empirical skepticism.

A similar ambivalence can be found in rationalism, particularly in the Cartesian tradition. René Descartes advanced the method of systematic doubt, casting suspicion on the reliability of the senses and questioning all supposed certainties. Rationalism, then, could be read as deterministic when it affirms universal laws grounded in reason,

but also as indeterministic when it insists that all knowledge must remain open to questioning. The rational method—meticulous, systematic, and skeptical—demonstrates that ***doubt itself is a rational act***, one that safeguards knowledge against dogmatism.

In both empiricism and rationalism, then, we see that determinism and indeterminism are not mutually exclusive labels applied from the outside. Rather, they are internal tensions within each paradigm, reflecting the dual demand of science: the need for order and predictability, and the recognition of uncertainty and contingency. This tension continues to animate scientific inquiry today, reminding us that the boundaries of knowledge are never fixed, but always open to revision in the light of new evidence and critical reflection.

11.13. Dialectics, Chaos, and Probabilities

Within **Hegelian dialectics** one can discern the foundations of many of today's theories of chaos and complexity. The dialectical method rests upon the principle of the **identity of opposites**, whereby what appears insignificant can, under the right conditions, become determinative. In other words, dialectics shows how the smallest or least probable possibility may, when the ***conditions of possibility*** align, transform into an inevitable outcome.

From the perspective of *Impossible Probability*, this insight is made precise: if a possible event is given ***sufficient time***—or, in the limit, infinite time—it may occur, no matter how close its probability is to zero. Under certain conditions, even events formally assigned a probability of zero can still manifest. This demonstrates that dialectical idealism, contrary to claims that it represents a closed deterministic system, is in fact deeply **indeterministic**. It acknowledges contingency, ***surprise***, and transformation as inherent features of reality.

A parallel can be drawn with the work of **Karl Marx**. Although Marx's materialism has often been vulgarized into a form of simplistic economic determinism, such interpretations miss the true transcendence of **dialectical materialism**. At its core,

Marx's thought seeks to grasp the **contradictions of social life**, contradictions arising from multiple factors: the development of the productive forces, the advancement of science and technology in their industrial applications, and the emergence of a proletarian class within a particular mode of production—at present, capitalism.

These contradictions generate a multiplicity of potential historical scenarios. Their resolution could lead either toward the realization of **scientific socialism**—a social, technological, and scientific order based on equality and rational planning—or toward catastrophic regression into **barbarism** and savage capitalism. Thus, both Hegelian dialectics and Marxian materialism resist reduction to deterministic models. Instead, they embody a profound awareness of the **indeterminacy of history**, where probabilities, contradictions, and human agency coalesce in unpredictable yet intelligible ways.

[Our first intention, while José Rodríguez Delgado was still alive—Delgado was, in the end, a disciple of Juan Negrín—was to transform *Impossible Probability* into a kind of manifesto, a warning for social studies about what the AI revolution could unfold for human society. We actually had something like a Marxist manifesto. Fourteen years after Delgado's death, the situation in AI has changed so dramatically that our perspective is completely different. It is already too late for new reformulations of Karl Marx. In the near future the impact of AI will be so incredible that the point is not how we can advise or warn about what is coming, because it is already here. Now our message is completely different; it is not about how we can redefine Marxism—it is too late. It is about how to make the cyborg revolutions as smooth as possible in order to reduce the social impact, especially the economic impact of AI, and to make the AI revolution affordable and a real solution. When AI arrives, especially left-wingers are going to try to accuse our program of fascism. The truth is that while José Delgado was still alive, we tried to send our message. We failed, and now the consequences are here. The Cyborg Revolution is coming. The intention of Karl Pribram and Jose Delgado was never to create a cyborg dictatorship in the middle of the Cold War, but the opposite, only the people who worked closely with them, knew what they did]

11.14. Science, Freedom, and Ethics

In light of these considerations, it becomes imperative to resist any attempt to construct science on a purely deterministic foundation that denies **human freedom**. To negate freedom is simultaneously to negate **morality and ethics**, since ethical judgment is only possible where free choice and responsibility exist. Humanism, therefore, must be a cornerstone of contemporary scientific transformation.

The task of our time is to rethink the relationship between science, technology, and society in ways that safeguard and expand human freedom. This requires advancing **free will** as the basis of human critical reason, and through critical reason, enabling the **rational transformation of reality**. Science must not be framed as the execution of a cosmic or master plan but as the outcome of deliberate **scientific policy**, defined and refined by human beings themselves.

Such a scientific policy must be attuned to the **complex nature of humanity**, integrating both objective and subjective variables. It must design models that incorporate not only technological progress but also ethical and social dimensions, ensuring that the development of science and technology serves the comprehensive needs of a rapidly growing global population. Humanity, now surpassing seven billion individuals and still expanding, faces unprecedented challenges: a severe financial crisis triggered by the collapse of the credit bubble in 2008, and a generalized ecological and environmental crisis whose future consequences may be catastrophic.

[Just to remind that we wrote this document In 2011, and there was no real risk that the global population could start declining so fast, as it is right now happening. From our pint of view the decline in the global birth rate must be observed as a real opportunity to recalibrate the work force given the impact of AI. While some conservative governments try to boost maternity, from our point of view, the point is no tot rise global birth rate, due to the massive unemployment that AI may generate. The point is to consider the radical adaptation of the human body-mind to the upcoming cyborg revolution we mean. Concepts such as family are going to face a radical change. It is not about the sexual revolution in the 60s or the pill, or about the LGBTQ+ Revolution or gender revolutions. All these revolutions together are a good opportunity to rethink

about concepts like family, global birth rate, maternity, and technology, in a world under global AI governance: instead of thinking of a new baby boom, is time to think about what real global population will be sustainable by the time that the global AI arrives, at the same time that we face global warming, world food production crisis, world health crisis, and a chain of natural disasters due to human impact , in order to create a more stable future it is time to plan global population and how to introduce as smooth as possible the cyborg revolution in combination with Superintelligence and the global AI, being aware that this is not another industrial revolutions like the steam machine, actually AI is not to mean a industrial revolution, because AI is a post-industrial revolution in a post-human world, at some point AI is a Nietzsche revolution, a postmodern revolution under the conditions created by the Globalization]

These crises compel us to develop **new scientific, technological, and social models** that are sustainable, equitable, and resilient. The science of the future must thus be inseparable from ethical reflection and political responsibility, recognizing that the transformation of reality is not only a matter of technological capacity but also of human values and collective choice [one more time again, this was written in 2011, now we have to reframe the concept of "human values" and speak more about "post-human values", and instead of "collective choice", we need to reframe that speaking of "AI-Cyborg collaboration"].

11.15. Impossible Probability and Critical Rationalism

The theory of **Impossible Probability**, in this context, can be understood as both **positivist** and **dialectically materialist**. It is positivist insofar as it affirms the necessity of grounding science in the **positive fact**—that is, in verifiable phenomena that serve as the basis of knowledge. Yet it is also dialectically materialist because it recognizes that facts are never neutral: the "positivity" of a fact is always mediated by the **political model** in which it is interpreted. Scientific discourse, therefore, is not purely objective but inevitably **political and ideological**, embedded within the broader narrative of scientific and technological progress.

Impossible Probability thus positions itself as a **rationally critical theory**, one that upholds the emancipatory mission of **critical reason**. This emancipatory mission is not merely philosophical but **technical and mathematical**: critical reason is conceived as the scientific capacity to subject reality itself to critique through rigorous models of probability and logic.

This critique of reality operates on two interconnected levels: the **moral** and the **mathematical**. Moral critique interrogates the ethical dimensions of scientific and social life, while mathematical critique examines the structural coherence, probability, and internal consistency of events and models. Within Impossible Probability, these two forms of critique are not separate but must be **synthesized by critical reason**.

Critical reason, therefore, serves as the mediator between the **a priori reality** (the given world, inherited as a set of facts and conditions) and the **a posteriori reality** (the transformed world, produced through scientific policy and human action). By designing a **scientific plan of history**, ***political science—guided*** by critical reason—transforms given reality into a new one. In this process, progress is understood as both intellectual and material, oriented toward higher moral and ethical forms of historical reality, framed by the ongoing advancement of science and technology.

11.16. The Concept of Progress: Scientism versus Ethics

At this juncture, it is necessary to distinguish between two competing conceptions of **progress**.

The first is the **scientistic conception**, which aligns with deterministic and mechanistic models, particularly those rooted in positivism. According to this view, progress consists solely of **scientific and technological advancement**. The underlying assumption is that technological innovation by itself will automatically bring about social progress. This conception is closely tied to the mechanistic belief in linear causality: the advancement of science guarantees, by necessity, the advancement of society.

The second conception is the **ethical and moral understanding of progress**. Here, progress is not defined merely by scientific or technological achievements but by the movement toward a society organized around principles of **ethics and morality**. This view is more closely aligned with **idealism, critical rationalism, and dialectical materialism**, which emphasize that technological development without moral orientation risks producing alienation, inequality, or even catastrophe.

Thus, progress must not be reduced to a purely technical phenomenon. It must be framed within a moral and ethical horizon that ensures scientific and technological growth serves the broader goals of justice, equality, and human dignity.

11.17. The Critical Synthesis of Progress

From the perspective of **critical reason**, these two notions of progress—scientistic and ethical—must not be treated as antagonistic opposites. Rather, they should be seen as complementary poles of a **dialectical contradiction**. Their tension generates the possibility for synthesis, in which the benefits of scientific and technological development are integrated with the demands of ethical and moral progress.

This synthesis is not automatic; it requires deliberate **praxis** under the guidance of a coherent **scientific policy**. Such policy must direct the dialectical resolution of contradictions between material progress and ethical responsibility. Only by doing so can humanity achieve a form of progress that is both **technologically advanced and morally sustainable**.

In this light, critical reason emerges as the indispensable faculty that mediates between scientific rationality and ethical responsibility. It ensures that progress is not one-sided—either narrowly technological or merely moralistic—but a **synthesized project of humanity**, uniting science, technology, and ethics in the ongoing transformation of reality.

11.18. Non-Linear Progress and Dialectical Cycles

Scientific, technological, and social progress—understood also as moral and ethical progress—should not be conceived in terms of simple, linear growth models. It is misleading to frame progress either as **arithmetic growth** (a constant, incremental *accumulation*) or as **geometric growth** (an exponential and unlimited *acceleration*). Instead, progress must be understood as **non-linear**, developing within **dialectical cycles** characterized by continuous spirals of **advance and retreat, error and correction, failure and learning**.

This model rejects the notion of an uninterrupted trajectory toward perfection. Human history demonstrates that progress is uneven and often paradoxical: moments of great advancement coexist with regressions, crises, and contradictions. Yet these setbacks are not mere obstacles; they are constitutive moments of the dialectical process through which humanity evolves. Each error becomes the condition for new learning, and ***each crisis opens the possibility for renewed transformation*** [this is Hegel, this is Marx, and this should Impossible Probability].

Within this spiral dynamic, humanity, exercising its **free will**, shaped by both social and individual contingencies, confronts and resolves its inherent contradictions. These contradictions can be intimate (within individuals), social (within communities), or systemic (within global structures). ***The resolution of contradictions***, although temporary and provisional, continually pushes humanity toward an **ideal horizon of freedom and equality**.

Thus, non-linear progress is best understood as an ongoing **dialectical praxis**, where free will operates within the constraints of chance and history, moving always—though never in a straight line—toward the realization of humanity's highest ideals: liberty, equality, and the possibility of genuine self-determination within a framework of ***equal opportunities.***

11.19. Chance, Causality, and Random Variables in Science

The natural and social sciences, as well as the phenomena they study—history, space, and time—cannot be reduced to a deterministic entity governed by a **cosmic plan** of physicochemical necessity, nor by a metaphysical **master design** of transcendent origin. Reality, beyond any reasonable doubt, is fundamentally the product of the **interaction of random variables**.

These variables do not imply that reality is incomprehensible or chaotic in an absolute sense. Rather, under specific conditions, they can be studied through **causal explanatory models** built upon statistical **correlations**. Such models, however, must always recognize the role of **error margins** and the unavoidable element of **chance**.

Within this probabilistic framework, not only can ordinary events be explained, but even what appears impossible may, under conditions of logical coherence, become **inevitable**. That is to say, when random variables interact within structured contexts, outcomes that seem improbable—or even assigned a probability of zero—can still occur.

In this sense, science must abandon the illusion of absolute determinism and embrace a methodology that integrates randomness as an essential component of causality. ***Randomness is not the negation of science; it is the condition for a deeper, more realistic understanding of how events unfold within both nature and society [and technology].***

11.20. Probability as a Scientific Foundation

For this reason, **the theory of probability** becomes indispensable as a foundational pillar of scientific thought. From the moment it is recognized that reality does not always follow regular or perfectly predictable patterns, probability offers the conceptual framework to analyze and classify phenomena.

In practice, reality often behaves according to **normal distributions**, but even these must be critically examined. The concept of "normality" allows science to distinguish between different types of behaviors: those tending toward **positive or negative bias**, and those oriented toward **equality of opportunity**. Probability provides the tools to determine, within given conditions, what outcomes are most likely, and under what circumstances deviations from the norm should be expected.

Within this framework, **normality itself is probabilistic and contingent**. It depends on the type of sample, the scope of the study, and the methodological choices of the researcher. A model designed to safeguard equality of opportunities, for example, will frame "normality" differently than one concerned solely with efficiency or optimization.

Thus, probability does not reduce reality to rigid laws but instead recognizes its **random yet patterned character**, allowing science to balance between prediction and uncertainty. It reaffirms that what is most normal, under normal conditions, is precisely that everything tends toward **normality itself**, albeit an **aleatory normality** that preserves the openness of chance.

11.21. Critical Reason and Scientific Policy

In the study of reality, **critical reason** is indispensable. Its role is to determine when reality follows a rational model and when it deviates, always in relation to the objectives and frameworks established by **scientific policy**. Critical reason functions as the evaluative principle that tests whether scientific models are valid not only in theory but also in practice.

However, for scientific policy to fulfill this role, it must first be defined according to principles that are **moral and ethically coherent**. In other words, scientific policy must be **positive** not just in the sense of being grounded in facts, but also in being ethically justified. A policy that ignores ethical considerations risks transforming science into an instrument of domination rather than emancipation.

Thus, critical reason and scientific policy are inseparable. Critical reason provides the rational and mathematical tools to assess models, while scientific policy provides the

moral and ethical direction that ensures science serves humanity's broader goals. Together, they safeguard the possibility of a science that is both rational and humane, predictive and emancipatory, rigorous and ethically responsible.

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12. Maximum Possible Empirical Bias

12.1. The Sufficiency of a Hypothesis in Rational Critique

The problem of determining whether a given **tendency in observed events** is sufficient to support an empirical hypothesis is central to rational scientific critique. For a hypothesis to be considered rationally acceptable, one must establish a **percentage of sufficiency**—a threshold that expresses how much error or uncertainty the scientific policy is willing to tolerate. This percentage of sufficiency is applied to the **maximum tendency** that a phenomenon may display, and only if the empirical observation reaches or exceeds this adjusted threshold can the hypothesis be deemed "sufficiently true."

The percentage of sufficiency corresponds directly to the **margin of reliability or error** that a given scientific community or policy framework is prepared to admit. In this way, rational critique does not claim to establish absolute truths but rather to evaluate whether an empirical proposition is sufficiently reliable to enter the domain of science.

Once a collection of hypotheses has met this criterion of sufficiency, they can be synthesized into a ***theory***. Theories that themselves meet the standard of rational sufficiency *may then form the basis of a* ***model***, whether empirical (based on direct data) or theoretical (based on mathematical or logical structures). Finally, one or more models, if coherently integrated, can provide the foundation of a **scientific paradigm**. Thus, rational critique, by setting a standard of sufficiency, provides the methodological link that moves knowledge from isolated hypotheses to theories, from theories to models, and from models to paradigms.

12.2. Rational Critique Based on the Error Percentage

When rational critique is framed in terms of **error *tolerance***, the method proceeds as follows: the percentage of error (divided by one hundred) is multiplied by the maximum possible tendency of the event under consideration. The resulting value defines the **minimum margin of error** that scientific policy is willing to accept with respect to that hypothesis.

The logical consequence of this formulation is that if the **empirical value** of the event is **equal to or lower than this critical value**, the hypothesis may still be accepted as rational. In this context, the critical value is also referred to as the **critical probability** or **critical reason**. Thus, the rational critique of hypotheses based on error percentages acknowledges that some hypotheses may be accepted even when the empirical evidence is not perfectly aligned with the theoretical maximum, so long as the divergence does not exceed the tolerable error margin.

This framework reflects the pragmatic recognition that absolute certainty is unattainable in empirical science; hypotheses are admitted into scientific discourse not because they are flawless, but because their divergence from expectation falls within an acceptable range of error.

12.3. Rational Critique Based on the Reliability Percentage

Alternatively, rational critique can be framed in terms of **reliability rather than error**. In this case, the process is inverted: the scientific policy sets a minimum level of reliability it is ***prepared to accept***. This reliability percentage (divided by one hundred) is multiplied by the maximum possible tendency of the phenomenon, and the result defines the **margin of reliability** that the hypothesis must meet in order to be validated.

The rule here is symmetrical to that of the error-based critique, but now adapted to a reliability: if the **empirical value** of the hypothesis is **equal to or greater than the critical value** (the critical probability or critical reason), then the hypothesis is accepted as sufficiently rational. The focus, however, shifts from minimizing error to maximizing reliability.

This approach emphasizes the **affirmative aspect of validation**: ***instead of calculating how much deviation is tolerable, it defines how much empirical support is required for a hypothesis to count as rationa***l. Both approaches—error-based and reliability-based—are dialectically related, since a margin of reliability always implies a complementary margin of error, and vice versa.

12.4. The Critical Value and Critical Reason

In both approaches—error-based and reliability-based—the **critical value** remains the same in structure: it is the **product of the maximum possible tendency of the phenomenon and the percentage of error or reliability that scientific policy is willing to accept**. This critical value, expressed as a probability, is what we term the **critical reason**.

The critical reason functions as the decisive threshold in rational critique:

- In an **error-based study**, any empirical value **equal to or below** the critical reason is accepted as rationally valid.
- In a **reliability-based study**, any empirical value **equal to or above** the critical reason is accepted as sufficiently rational.

This formulation highlights the central role of **critical reason** in **structuring rational critique**. It operationalizes the relationship between **empirical observation and scientific policy**, ensuring that acceptance or rejection of hypotheses is not arbitrary but grounded in a transparent, mathematically defined threshold. In this way, critical reason embodies the synthesis of logic, mathematics, and scientific policy in the evaluation of empirical truth.

12.5. Maximum Tendency: Empirical or Theoretical

The determination of the **maximum tendency** of an event—meaning the highest value toward which a phenomenon can incline—depends on two key considerations. First, it depends on whether the analysis is framed in terms of **error tolerance** or **reliability**

acceptance. In other words, whether the maximum tendency is multiplied by a percentage of error or a percentage of reliability, divided by one hundred. Second, it depends on whether the tendency in question is an **empirical maximum** (based on actual observed data) or a **theoretical maximum** (derived from mathematical or logical reasoning).

This distinction is crucial. Theoretical maximum tendencies serve as abstract limits grounded in probability theory, while empirical maximum tendencies reflect what is actually possible within real-world datasets. The critical reason, therefore, can only be properly defined if one specifies not only the margin of error or reliability but also whether the reference point is empirical or theoretical.

12.6. Maximum Possible Empirical Bias and Maximum Possible Theoretical Bias

Before moving forward to a detailed examination of **critical reason** and the various models of rational critique, it is essential to clarify the logic of the **Maximum Possible Empirical Bias** and its differences from the **Maximum Possible Theoretical Bias**.

Theoretical bias is defined abstractly, based on what would occur under perfectly constructed probabilistic models. Empirical bias, by contrast, is constrained by the statistical behavior of actual observed frequencies in a sample. Understanding this distinction allows us to measure how far reality departs from theoretical expectation and, in turn, to evaluate hypotheses within the bounds of rational critique.

By establishing these categories, *Impossible Probability* ensures that rational critique does not rely solely on idealized abstractions but also incorporates the **dialectical relation between the real and the ideal**—between empirical data and theoretical possibility.

12.7. The Dialectic of the Real and the Ideal in Impossible Probability

One of the defining strengths of *Impossible Probability* is its insistence that for every **theoretical value**, there normally exists a corresponding **empirical value**. This is a

direct application of the **dialectical principle**, according to which every real element has an ideal counterpart, and vice versa.

In this framework, empirical and theoretical perspectives are not antagonistic but mutually constitutive. The real manifests itself in observed data, while the ideal provides the conceptual *models that guide interpretation*. Together, they allow for a more complete understanding of probability, bias, and rational critique. Without this dialectical balance, scientific reasoning risks collapsing either into pure abstraction (*ignoring reality*) or into mere empiricism (*without theoretical orientation*).

12.8. Definition of Bias Level

Within *Impossible Probability*, the **Bias Level** (*Nivel de Sesgo*) is defined as the difference between **empirical probability** and **theoretical probability**.

- **Empirical probability** is calculated as the direct value or frequency of a subject or option.
- **Theoretical probability** is defined as the reciprocal of **N**, where N is the total number of subjects or options in the sample.

Formally, the Bias Level is expressed as:

$$\text{Bias Level} = p(x_i) - \frac{1}{N}$$

This formula quantifies the deviation of observed reality from theoretical expectation. Positive bias indicates that an outcome appears more frequently than theoretical uniformity would predict, while negative bias indicates that it appears less frequently. The Bias Level thus provides the fundamental unit of analysis for rational critique of empirical data.

12.9. Rational Critique of Bias and Validity

If one wishes to evaluate whether a given bias is sufficient to support a hypothesis, the analysis must proceed by comparing the observed bias with the **critical reason**. This is calculated by multiplying the **maximum possible bias** by the percentage of error or reliability that scientific policy is willing to accept, divided by one hundred.

Thus, critical reason establishes a **rational sufficiency threshold** for bias:

- If the empirical bias surpasses this threshold (in the case of reliability studies), it is accepted as sufficient.
- If the empirical bias falls below or equal to the threshold (in the case of error studies), it is also rationally acceptable.

In practice, studies of **Validity** generally adopt this logic. For the **Validity of Equality** or the **Validity of Positive Bias**, the analysis is usually based on the **Maximum Possible Theoretical Bias**, except in cases of **Negative Bias Validity**, where empirical adjustments must be considered.

By structuring rational critique in this way, *Impossible Probability* ensures that validity assessments are not arbitrary but grounded in a precise calculation of how much deviation can be rationally tolerated.

12.10. Validity of Positive Bias

In the study of **positive bias**, the **Validity of Positive Bias** is defined as the difference between the **empirical probability** of an outcome and the **critical reason** (or critical probability). In this case, the critical reason is calculated as the **Maximum Possible Theoretical Bias** multiplied by the accepted percentage of reliability, divided by one hundred.

Formally:

$$\text{Validity of Positive Bias} = p(x_i) - \text{Critical Reason}$$

This definition ensures that positive deviations from theoretical expectation are only considered valid when they exceed the reliability-adjusted threshold. In other words, not every apparent positive bias is significant; only those strong enough to surpass the critical reason can be rationally affirmed as evidence of a valid hypothesis.

12.11. Validity of Negative Bias

In the case of **negative bias**, validity is defined differently than in the case of positive bias. Here, the **Validity of Negative Bias** is equal to the difference between the **critical reason** and the **empirical probability** of the outcome in question.

Formally:

$$\text{Validity of Negative Bias} = \text{Critical Reason} - p(x_i)$$

The **critical probability (or critical reason)** in this context is calculated as the product of the **reciprocal of N** (that is, 1/N, where N represents the number of possible options in the sample) multiplied by the accepted error percentage divided by one hundred.

This formulation recognizes that negative bias involves cases where observed outcomes occur **less frequently** than theoretical expectation would predict. By

comparing the empirical probability to a ***scaled*** error-adjusted threshold, rational critique can determine whether the deficiency in occurrence is statistically significant and thus rationally valid as evidence.

12.12. Alternative Maximum Empirical Tendencies

The fact that the **Validity of Positive Bias** and the **Validity of Equality** are normally based on the **Maximum Possible Theoretical Bias** does not mean that no other forms of maximum tendencies exist. On the contrary, if every ideal has a real counterpart—as dialectical reasoning asserts—it follows that, just as one can define a maximum theoretical tendency, one can also **estimate the maximum empirical tendency** of a bias.

This recognition broadens the analytical framework of *Impossible Probability*. It allows for the construction of alternative models of rational critique that are grounded not only in abstract theoretical maxima but also in the **empirical limits** observed in real data.

12.13. The Logic of the Sum of Biases

If the empirical bias of a subject or option is defined as the difference between its empirical probability and its theoretical probability (i.e., empirical probability minus 1/N), then by **natural symmetry** the sum of all biases in a system must equal zero, at least in theory:

$$\Sigma \left(p(x_i) - \frac{1}{N} \right) = 0$$

This identity holds because every **negative bias** is offset by a corresponding **positive bias**. In other words, ***the sum of all negative deviations must equal the sum of all positive deviations***. When two values are identical in magnitude but opposite in sign,

their sum necessarily cancels out to zero, provided the calculations are performed correctly.

This principle reflects the ***dialectical law of opposites***, articulated in Hegelian philosophy: opposites are identical precisely because they are contrary. Within probability theory, this law manifests in the balancing of positive and negative biases, which ensures that the aggregate ***system remains internally consistent***.

12.14. The Dialectic of Opposites in Hegel

In **Hegelian dialectics**, opposites are considered identical precisely because they are contrary. This is one of the fundamental laws of dialectical logic***: every phenomenon contains within itself its negation***, and the identity of opposites is established through their contradiction.

Applied to probability and bias, this principle implies that **positive deviations and negative deviations are not external to each other but internally related**. The existence of positive bias presupposes negative bias, and together they constitute a unified whole in which balance is achieved through opposition. Within this framework, the dialectical law is fulfilled perfectly: the totality of deviations resolves itself through the equivalence of opposites.

12.15. Maximum Possible Empirical Probability

If the dialectical principle of balance between positive and negative holds true, then in a hypothetical case where one subject or option reaches its **maximum individual tendency**—namely, **Maximum Possible Empirical Probability**, or probability one ($p(x)=1$)—a specific scenario arises.

Suppose in a set of N options, one subject has empirical probability equal to one, while all others have probability equal to zero. This is the extreme case on which the **Maximum Possible Theoretical Bias** is constructed. Empirically, the result would be

that the single subject with nonzero probability has a **positive bias**, while all remaining N−1 subjects or options necessarily exhibit **negative bias**.

If the principle of natural balance is correct—namely, that all negative deviations compensate for all positive deviations—then the **sum of all negative biases** must be exactly equal in magnitude and opposite in sign to the **single positive bias** of the option with probability one. This confirms that even in extreme empirical scenarios, the dialectical law of compensation between opposites holds firm.

12.16. Definition of Total Bias

If it is indeed the case, and it necessarily must be so (apodictically), that in the sum of all biases the negatives balance out the positives, then one can define a new statistical measure: the **Total Bias**.

This is calculated as the **sum of the absolute values of all biases** across the system:

$$\text{Total Bias} = \Sigma \left| p(x_i) - \frac{1}{N} \right|$$

The Total Bias thus represents the aggregate measure of deviation from uniform theoretical distribution. It captures the full extent of divergence, both positive and negative, without allowing them to cancel each other out. This measure is indispensable for evaluating the empirical limits of bias within rational critique.

12.17. Maximum Possible Empirical Bias

From the definition of Total Bias, an important constraint can be established: **no single subject or option can empirically exhibit a Bias Level greater than half of the Total Bias**.

Formally:

$$\text{Maximum Possible Empirical Bias} = \frac{\text{Total Bias}}{2}$$

This rule reflects the empirical reality that the absolute value of any single bias—whether positive or negative—cannot exceed half the system's total divergence. It sets a concrete empirical ceiling beyond which no outcome can deviate.

Thus, the Maximum Possible Empirical Bias serves as a **practical statistical boundary**: it defines the maximum deviation observable in reality, ensuring that empirical analysis remains grounded within achievable limits, rather than drifting into purely theoretical extremes.

12.18. Conclusion: The Necessity of Maximum Possible Empirical Bias

As explained above, in the study of **Equality Validity** and **Positive Bias Validity**, the critical probability (or critical reason) is normally calculated using the **Maximum Possible Theoretical Bias**. However, for other models of rational critique—which will be further elaborated in section eleven of *Introduction to Impossible Probability*—it is essential to also employ statistics that capture **empirical maxima**, such as the Maximum Possible Empirical Bias.

This measure is indispensable for refining rational critique. By integrating both theoretical and empirical maxima, scientific analysis can better balance abstraction with observation, ensuring that rational sufficiency judgments are not based exclusively on idealized limits but also on what is demonstrably possible in practice.

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13. Critical Reason

13.1. Reason as a Qualitative and Quantitative Capacity

Reason, in its qualitative dimension, refers to the cognitive or analytical capacity of the subject—the subjective faculty through which human beings interpret and make sense of reality. In its quantitative dimension, however, reason is understood as an objective system of algorithms or mathematical functions that describes the relationships among variables. Regardless of whether the epistemological orientation is comprehensive (aimed at understanding) or explanatory (aimed at causal explanation), the ultimate purpose of reason remains the same: the pursuit of knowledge about what happens in reality.

Within the statistical study of probability—a field developed in *Introduction to Impossible Probability*—reason is explicitly treated as a mathematical and objective entity, defined through systems of algorithms and functions. For example, probability itself is a form of reason insofar as it is a rational number derived from a mathematical ratio. Every quotient expresses a mathematical proportion, and thus, whether one is dealing with empirical probability, theoretical probability, ideal probability, or critical probability, each is in essence a specific form of rational proportion.

Furthermore, if a proportion (expressed as a quotient) is considered a mathematical reason, then its inverse operation, multiplication, must also be considered a mathematical reason, this time of product. By extension, addition—the basis from which multiplication is constructed—must equally count as a mathematical reason, as must subtraction. In short, all mathematical operations and algorithms—whether powers, roots, derivatives, integrals, or systems of linear and complex equations—are ultimately models of mathematical reason.

13.2. Synthesis: Reason as Quantitative Analysis of Reality

Reason is, in essence, the capacity for quantitative analysis of reality. While it may ***originate in the subjective cognitive faculty of human beings, once it is defined in terms of its mathematical nature, reason ceases to be subjective and becomes an objective entity. It is transformed into a system of logical-mathematical operations capable of analyzing phenomena beyond individual perspective.***

This synthesis is particularly significant for the framework of *Impossible Probability*, where the transition from subjective interpretation to objective quantification forms the methodological basis of the entire project. Reason thus becomes a bridge between ***cognition and mathematics***, allowing for the construction of universal models of explanation and critique.

13.3. Models of Reason and the Definition of Critical Reason

Within the broader set of models of reason—whether explanatory or comprehensive, qualitative or quantitative—critical reason stands out as a specific form characterized by its critical nature. This critical nature derives from the fact that critical reason operates in accordance with pre-established criteria, that is, criteria defined ***a priori.***

Critical reason does not merely describe or interpret reality but evaluates it against predetermined standards. These standards may be moral, aesthetic, social, or mathematical, depending on the context. What makes reason "critical" is not the particular domain in which it operates but the presence of *a prior framework* of evaluation that guides its analysis.

13.4. Critical Reason in the Qualitative Sense

In a qualitative sense, critical reason refers to models of analysis that examine reality through qualitative criteria. For instance, in the field of artistic criticism, the analysis of a work of art is conducted according to aesthetic standards, artistic sensitivity, or

expressive value. Similarly, in the social sciences, qualitative paradigms often employ critical reason to evaluate social phenomena in terms of justice, equity, freedom, or social impact.

In these cases, the "critical" dimension does not depend on numerical calculation but on the application of qualitative benchmarks to assess meaning, value, or ethical significance. This form of critical reason highlights the interpretative and normative aspects of rational analysis while still maintaining a structured and systematic methodology.

13.5. Critical Reason from the Quantitative Epistemology

From a **quantitative epistemological perspective**, critical reason is defined as that mode of reason which operates through **logical-mathematical systems of analysis**. It examines what happens by applying **quantitative criteria**, and it is precisely the reliance on these criteria that gives critical reason its distinctive **critical character**.

In this framework, critical reason becomes essentially equivalent to a form of **mathematical critique**. What makes an analysis "critical" is not merely the act of describing data but the act of subjecting observations to **pre-established, quantifiable standards** that can confirm, reject, or refine hypotheses.

13.6. Quantitative Studies and Mathematical Critical Reason

Whenever a quantitative study of a given phenomenon is conducted according to **a priori quantitative criteria**—that is, rules established beforehand for defining situations or making decisions—the study is operating under **mathematical critical reason**.

An illustrative example comes from climatology. Suppose we wish to determine whether a particular region should be classified as desert, tropical, temperate, polar, or Mediterranean. Each climate type is defined by **a priori criteria**, such as ranges of temperature and annual rainfall. By comparing the recorded data for the region against

these predefined thresholds, the classification of the region will ultimately depend on which criteria it satisfies.

This procedure exemplifies how **critical reason functions mathematically**: the decision to classify a climate type is not arbitrary but dependent upon **quantitative, rational, a priori criteria**. The conclusion reached is therefore not a subjective interpretation but a structured judgment derived from critical reason.

13.7. Example: Social Classification in the Social Sciences

A similar process applies in the social sciences. Consider a study on the **distribution of a population into social classes**. Each class can be defined by **a priori quantitative criteria**, such as household income. Discrete categories are established, with specific lower and upper bounds for income ranges, and families are classified into a class depending on where their income falls.

In this case, the act of defining social stratification becomes an exercise of **quantitative critical reason**. The classification is not based on intuition or qualitative description but on **explicit numerical thresholds** that serve as the criteria for categorization. Thus, social reality itself is interpreted and structured according to critical reason.

13.8. General Definition of Critical Reason

In general terms, **critical reason** can be defined as the **capacity for analysis according to a priori criteria**. Its form depends on the nature of the criteria:

- If the analysis and the criteria are **qualitative**, then critical reason takes on a qualitative form.
- If the analysis and the criteria are **quantitative**, then critical reason becomes **mathematical** in nature.

This duality demonstrates the flexibility of critical reason as a methodological tool. It is not tied to a single epistemological orientation but rather adapts itself to the type of criteria being employed.

13.9. Critical Reason in *Impossible Probability*

Since the theory of *Impossible Probability* represents a **new framework for the study of probability statistics**, its foundation lies in a **quantitative rational definition**. Consequently, within this framework, **critical reason is understood mathematically**.

The mathematical expression of critical reason is what we call the **critical probability**. This concept serves as the adaptation of mathematical critical reason to the specific domains of **statistics and probability**, providing a precise way to formalize critical thresholds in the analysis of empirical and theoretical data.

13.10. Statistical Critique and Critical Probability

The critique of events in *Impossible Probability* is therefore conducted through a **statistical critique**, in which the **critical probability** functions as the a priori criterion. This critical probability is made explicit in the **process of hypothesis testing**, but it also operates implicitly—taken for granted—in the very act of defining reality through statistical models.

Thus, whether manifest or implicit, the **critical probability embodies the principle of critical reason in quantitative science**. It ensures that every empirical judgment is framed not by arbitrary opinion but by rational, pre-established thresholds of acceptance or rejection, rooted in the logic of probability.

13.11. Example: Empirical Hypothesis on Social Class and Academic Performance

Let us consider a study on the **distribution of school performance across social classes**. The empirical hypothesis to be tested is that **social class membership is a variable that influences the academic performance of students** within an educational system.

To investigate this hypothesis, social classes are first defined according to **quantitative criteria**—for example, family income thresholds—that allow students to be classified

into distinct categories of social stratification. Once students are grouped according to these predefined criteria, the analysis seeks to determine whether their class membership correlates with differences in school performance.

Finally, in order to verify whether the empirical hypothesis is provisionally true, the analysis introduces a **critical probability**, which functions as the threshold for rational acceptance or rejection. By applying this critical standard, the hypothesis can be evaluated in a way that is both systematic and grounded in quantitative rational critique.

13.12. Definition of the Proportion of Academic Success

Suppose that the value **"Z"** represents the **probability of academic success** for students from higher social classes, while the value **"W"** represents the probability of academic success for students from lower social classes.

To determine whether social class significantly influences academic outcomes, one calculates the **empirical ratio** between these two probabilities:

$$\text{Proportion of academic success between lower and higher social classes} = \frac{W}{Z}$$

This ratio provides a measure of **equality of opportunity**:

- The closer the proportion is to **1**, the greater the guarantee of equality of opportunity between higher- and lower-class students.
- The closer the proportion is to **0**, the weaker the guarantee of equality of opportunity, indicating that social class exerts a stronger influence on school performance.

This formulation exemplifies the type of proportional analysis described in section 11 of *Introduction to Impossible Probability*, where ratios serve as tools for comparing empirical probabilities in order to assess hypotheses.

13.13. Establishing Critical Reason in Hypothesis Testing

In order to establish a **predefined criterion** by which scientific policy can decide whether or not equality of opportunity exists, the analysis introduces a **critical reason**, expressed as a **margin of reliability**.

This critical reason sets the threshold:

- If the empirical ratio (W:Z) minus the critical probability p(xc) is **zero or positive**, then the empirical hypothesis—that social class influences academic performance—is **rejected**. In this case, equality of opportunity is deemed to be sufficiently guaranteed.
- If, however, the ratio falls below this threshold, the hypothesis of social class influence cannot be rejected.

Formally:

$$(W:Z) - p(x_c) \geq 0 \quad \Rightarrow \quad \text{Reject the hypothesis that social class influences school performance}$$

where

$$p(x_c) = \frac{X}{100}$$

And **X** represents the **percentage of reliability** determined by scientific policy.

This model of hypothesis testing highlights the central role of **critical probability** as the operational form of **critical reason** in quantitative science. It makes explicit how decisions of acceptance or rejection in empirical research are grounded not merely in observation but in **a priori rational criteria** established by the governing framework of scientific policy.

13.14. Implicit and Explicit Decisions in Scientific Policy

Hypothesis testing models such as the one described above are developed in greater detail in section 11 of *Introduction to Impossible Probability*. However, even within this relatively simple exercise of rational critique, it becomes evident that **scientific policy involves more than a single decision**. Beyond determining sample size, the selection of variables, the design of the study model, or the choice of the critical probability p(xc), other decisions are already embedded in the structure of the research.

For example, the very act of defining **social classes** through **a priori quantitative criteria** is itself a critical act of definition. This entails the implicit acceptance—without explicit debate in this particular study—that society is stratified into classes and that such stratification can be measured by variables such as average household income. In this case, the criteria for social stratification were **assumed implicitly** as part of the **theoretical paradigm** guiding the research.

Thus, while the **explicit critical element** in this study was the definition of the **critical probability** in the rational critique of the ratio between success rates of lower-class students (“W”) and higher-class students (“Z”), the implicit decisions were equally significant. They structured the very framework within which the explicit rational critique could occur.

13.15. Coexistence of Models of Critical Reason

In this way, a single study may contain **multiple models of critical reason simultaneously**. Some models remain **implicit**, assumed as part of the prevailing

paradigm from which scientific policy derives its theory. Others are **explicit**, manifest in the hypothesis-testing process itself.

Both dimensions are integral to rational critique: the implicit assumptions establish the background framework, while the explicit models guide the **critical testing of empirical hypotheses**. Together, they demonstrate that scientific critique is never purely procedural but always situated within a broader network of paradigmatic assumptions and explicit methodological decisions.

13.16. Strict Definition of Critical Reason in Inferential Statistics

In a stricter sense, within **inferential statistics** as framed in *Impossible Probability*, **critical reason** refers specifically to the **a priori quantitative criterion** employed in the rational critique of ideas for the purpose of hypothesis testing. Mathematically, this is expressed as the **critical probability**.

Critical reason is thus the analytical capacity to evaluate ideas according to **pre-established mathematical criteria**, allowing researchers to determine provisionally "what is happening." Yet, because such judgments are always made within the framework of an **error margin** or a **reliability margin**, every acceptance of reality inevitably contains the possibility of error. When such error is unavoidable, every acceptance of reality is, in a sense, **necessarily erroneous**.

Nevertheless, these provisional acceptances are also **universally necessary** for the progress of science. They are judgments that hold true universally under the conditions of current knowledge, even though they remain provisional. Hence, the logical outcome of hypothesis testing is the issuance of **universal yet provisional truth-claims**, which carry a moral dimension: they are judgments of truth that guide collective understanding until future events or new evidence transform them.

13.17. Inference and Universal Provisional Judgments

The purpose of **inferential statistics** is to produce **inferences in the form of universal and provisional judgments**. Such judgments are admitted only if they pass the rational critique imposed by critical reason, mathematically expressed through the critical probability.

This process is not purely technical but is also conditioned by ***scientific policy, which itself is shaped by ideological, epistemological, political, economic, and social interests. Thus, the establishment of critical reason reflects not only a logical or mathematical necessity but also a broader contextual decision rooted in the values and priorities of the society and institutions conducting the research.***

In this way, inference in *Impossible Probability* demonstrates both the **power and the limitation of rational critique**: it can yield universal provisional truths, but these **truths are always framed within margins of error and shaped by political and ideological contexts.**

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14. Rational Critique and the Validity of Equality

14.1. Definition of Rational Critique of Reality

The rational critique of reality may be defined as the logical act by which, employing a rational criterion, one determines whether what is observed is sufficient—or insufficient—to transform an empirical hypothesis into a rational one. An *empirical hypothesis* is understood here as any proposition whose aim is to establish an isomorphism between idea and reality, and which must therefore be subjected to systematic contrast.

In more explanatory terms, rational critique is not mere skepticism nor blind acceptance, but rather the disciplined evaluation of whether a given hypothesis corresponds with the observable world in a manner that can be judged rational. The hypothesis must pass from the stage of being merely empirical—a descriptive suggestion based on observation—to being rational, i.e., a proposition endorsed by reason because it has successfully endured a process of logical verification. ***This process requires both empirical data and rational judgment***, combining observation with logical criteria that ensure internal coherence and external correspondence.

14.2. Contrast Between Empirical Hypothesis and Reality

In this sense, rational critique is fundamentally the act of contrast between the idea (the empirical hypothesis) and reality itself. A hypothesis acquires the status of a rational hypothesis only when, through this contrast, scientific policy—or the governing standards of scientific practice—accepts that the empirical hypothesis is sufficiently true, within a defined margin of error, to be considered rational.

This formulation acknowledges that no hypothesis can ever perfectly mirror reality; there is always a degree of approximation. What legitimizes an empirical hypothesis as rational is not absolute truth but *sufficient truth* within the limits of error deemed acceptable by the scientific community. Rational critique therefore operates as a threshold mechanism: it evaluates whether the proposition exceeds the minimum standards of empirical adequacy and logical coherence to enter into the domain of rational knowledge.

14.3. Example: Normal Behaviour in a Population

Consider, for example, the case of social or demographic research. If one begins from the hypothesis that, given a set *N*, the "normal" tendency of a population is towards a specific behaviour, then the definition of that normal behaviour must be established on rational criteria. Scientific policy, applying rational critique, would only accept such a proposition as rational if the hypothesis is supported by sufficient evidence and logical justification.

For instance, if one hypothesizes that within a given society the majority tends towards ***cooperative behaviour in conditions of scarcity***, then rational critique would demand that this claim be supported by data obtained through systematic observation and statistical inference. Moreover, the definition of "normal" must itself be rationally specified—whether in terms of majority behaviour, modal tendencies, or a defined confidence interval. Without such clarification and verification, the hypothesis remains merely empirical, lacking rational validity.

14.4. Example: Life Expectancy of Women and Men

Another illustrative example is the hypothesis that women have a higher life expectancy than men. To rationally validate this empirical hypothesis, it would not be necessary to prove that *every* woman lives longer than *every* man. Rather, one must demonstrate that a statistically significant proportion of women live longer than men, and that this trend holds across populations with sufficient regularity.

Rational critique acknowledges that within the margin of error there may be many men whose lifespan equals or surpasses that of many women. Such exceptions do not invalidate the hypothesis, because rational critique does not demand absolute universality but rather the predominance of the relation within statistically significant parameters. Thus, what is "normal" in this case, by statistical reasoning, is that women as a group exhibit higher life expectancy than men, even though individual variations persist.

This example underscores a crucial feature of rational critique: it evaluates hypotheses not by their ability to account for every single case, but by their capacity to explain general tendencies with sufficient reliability to be considered rational knowledge.

14.5. Example: Average Height Between Men and Women

Suppose one advances the hypothesis that the average height of men is normally greater than that of women. In order to rationally demonstrate this hypothesis, it is necessary to show empirically that a statistically significant proportion of women are shorter than men. At the same time, a margin of error must be accepted, within which it is possible that some women have identical height to men, or even surpass them in stature. These exceptions, however, remain within the boundaries of the margin of error and do not invalidate the general hypothesis.

Thus, the hypothesis that the mean height of men is greater than that of women can be considered rational only if, after empirical verification, the evidence shows this tendency with sufficient strength to be recognized by scientific policy. What matters is not absolute difference in each individual case, but the predominance of a measurable and statistically significant tendency. Rational critique requires the researcher to identify both the general rule (greater male average height) and the permissible range of exceptions, thereby demonstrating that the hypothesis is rational within the constraints of empirical variability.

This example demonstrates how rational critique uses statistical distribution to separate the "normal" trend from the exceptions. Equality here does not mean absence

of difference in every case, but equality of methodological treatment: both men and women are examined under the same logical and empirical criteria, and the hypothesis is judged rational only if it maintains validity after empirical contrast with allowance for variability.

14.6. Example: Games of Chance and Coin Tossing

Let us now consider a case in which equality of opportunities is absolute: the tossing of a fair coin. If we hypothesize that the outcome of tossing a coin under equal conditions should yield no disparity between the number of heads and tails, then rational critique evaluates whether the evidence sustains this expectation. Theoretically, in a model of perfect chance and fairness, each toss has a 50% probability of yielding heads and a 50% probability of yielding tails.

However, rational critique acknowledges that in practice, across a limited number of trials, deviations will occur. For instance, in a sequence of fifty tosses, one might obtain slightly more heads than tails, while in another set of fifty tosses, the opposite may occur. These deviations are consistent with randomness and do not invalidate the hypothesis of equal probability. The principle of rational critique therefore incorporates both the theoretical expectation of equality and the empirical recognition of variance across finite sequences.

This illustrates how rational critique treats “normality” in probabilistic contexts: not as perfect balance in every instance, but as a tendency toward balance across sufficient repetitions, within margins of error established by scientific policy.

14.7. Example: Series of Tosses and Statistical Compensation

The same principle can be observed when analyzing smaller sequences. In series of four coin tosses, there is no necessity for every sequence to result in two heads and two tails. By chance, some sequences may yield three heads and one tail, or three tails and one head. Rational critique interprets these outcomes not as refutations of equality but as statistical variations that, when aggregated across many sequences, tend to balance out.

The rational evaluation here lies in the recognition of *compensation over time*. Equality of probability does not mean immediate equilibrium in every small sequence, but rather a long-term statistical convergence. Thus, rational critique establishes that what is rationally "normal" is not perfect short-term equality, but the predictable balancing of frequencies across large numbers of trials.

This insight is crucial for scientific reasoning: hypotheses about equality must be judged not in terms of isolated events but in relation to long-term distributions, where compensation mechanisms allow empirical frequencies to approximate theoretical probabilities.

14.8. Empirical Variability Under Equal Conditions

From this perspective, rational critique recognizes that under conditions of equality of opportunity—such as in fair coin tossing—the empirical probability of heads or tails tends to converge toward the theoretical probability of one-half. Yet, at the same time, chance ensures that deviations will occur in particular samples or moments.

For example, in one sample, heads may appear more frequently than tails; in another, tails may dominate. Across a sufficiently large number of trials, however, the overall tendency is toward equalization. The rational critique of equality therefore includes two simultaneous dimensions: (1) the theoretical equality of probabilities derived from the structure of the model, and (2) the empirical variability produced by chance, which allows short-term imbalances without undermining long-term equilibrium.

Thus, rational critique demonstrates that equality in probabilistic systems must always be understood dialectically: as both a theoretical expectation of symmetry and a practical reality of fluctuating empirical distributions. Equality in this sense is not static or absolute, but dynamic, tending toward equilibrium through the accumulation of trials.

14.9. Example: Experimental Validation of a Medicine

Suppose a team of physicians studies a new drug designed to treat a specific illness. To test its effectiveness, they select a sample of patients to whom the drug is administered. If the medication is indeed effective, the proportion of patients who improve as a direct result of the drug should be significantly greater than the proportion observed in any control group that does not receive the treatment.

Rational critique acknowledges, however, that chance factors and uncontrolled variables inevitably play a role. Some patients may fail to improve not because the drug is ineffective in general, but because of random complications, pre-existing medical conditions, or external variables outside the scope of experimental control. The empirical test of the drug must therefore distinguish between improvement attributable to the medication and variation caused by chance.

This example illustrates how rational critique applies in experimental science: it identifies not only the observable effect but also the margin of variability within which random outcomes may occur. The drug can only be considered effective if, beyond this margin of chance variation, its beneficial effect on patients is demonstrated as statistically significant compared to the control.

14.10. Significant Criterion and Critical Reason in Validation

For the team of physicians to validate the drug rationally, the observed improvement rate among treated patients must be significantly greater than in the control group. Crucially, however, the criterion of "significance" must be established before the experiment begins. The researchers must determine in advance what level of difference in outcomes will be accepted as sufficient to rationally validate the empirical hypothesis that the drug is effective for treating the disease.

This pre-determined threshold is what rational critique defines as the *logical-rational criterion*—the *critical reason* or *critical probability*. It functions as the boundary that distinguishes between random variation and a genuinely rational conclusion. Within this framework, scientific policy plays a decisive role: it sets the methodological rules

that determine when observed evidence is “enough” to convert an empirical hypothesis into a rationally accepted truth.

Thus, rational critique is inseparable from methodological discipline: without a prior definition of significance, the empirical results cannot be judged in a logically rigorous way.

14.11. The Political and Moral Dimension of Critical Reason

Every act of critical reason is, in fact, an act of scientific policy. The moment in which researchers determine the logical-rational criterion, they are also making a political and ethical decision: they are deciding from what point onward a hypothesis will be accepted as rational truth, even though it remains open to refutation in the future.

This reveals the moral dimension of rational critique. Accepting a hypothesis as “sufficiently true” is never a purely neutral act; it involves ethical responsibility, since it implies consequences for patients, institutions, and society at large. For instance, approving a drug for public use requires balancing the potential benefits against the risks of error. Rational critique therefore demands not only logical rigor but also moral prudence, as truth is accepted within a defined margin of error that carries ethical weight.

14.12. Truth, Morality, and Scientific Policy

Truth is not neutral. To tell the truth is inherently a moral act, since morality demands truthfulness. At the same time, truth is political, because the standards for accepting truth vary according to the political model that governs scientific policy. Different systems may establish different thresholds of significance, different tolerances for error, and different procedures for validation.

In this sense, rational critique is situated at the intersection of logic, ethics, and politics. Logical, because it establishes criteria of significance; ethical, because it accepts

responsibility for the consequences of error; and political, because it is always embedded in institutional frameworks that define the acceptable margins of truth.

Thus, the validation of hypotheses—whether in medicine, social science, or natural science—is not only a technical matter but also a moral and political act. Rational critique reveals that truth in science is always contingent, always conditional upon the margins of error that society, through scientific policy, is willing to accept.

14.13. Example: Medicines, Quality, and Scientific Ethics

Suppose a pharmaceutical company places on the market a drug whose margin of error is higher than that of a competing company's drug. Is it morally and ethically acceptable to prescribe or distribute a medication of lower quality when another, demonstrably more effective and reliable one exists?

This question touches the very heart of rational critique and ethics in science. Medicine is not only a technical matter of proving efficacy within a margin of error but also a moral responsibility toward human life. In reality, there are many diseases for which a wide range of drugs are available, each produced by different pharmaceutical companies, with varying levels of quality, and—most troublingly—vastly different prices.

This situation places human life at the mercy of purchasing power, endangering those who lack sufficient resources. Rational critique in this context must go beyond technical validation and confront the ethical problem of distributive justice: whether it is acceptable for access to higher-quality truth (in the form of better medicine) to be conditioned by economic inequality. Thus, rational critique is inseparable from questions of social justice and the ethical use of scientific knowledge.

14.14. Rational Critique as the Politics of Truth

Every rational critique of reality is inherently political, insofar as *scientific policy* determines the level of rigor required to accept only those propositions that are as

isomorphic as possible to reality—that is, those empirical hypotheses most closely approximating pure truth.

Human beings, however, can never attain absolute truth, for this would require full knowledge of the infinite. Logically, the infinite cannot be fully contained within the finite, and human cognition, being limited and finite, can only grasp partial truths, samples of reality, and fragments of the whole. Absolute truth remains beyond our reach.

Rational critique thus operates as a political filter: it sets the standards that decide how close a hypothesis must come to truth in order to be accepted. The act of critique is simultaneously logical, because it establishes criteria; moral, because it concerns the consequences of error; and political, because it reflects the institutional and cultural framework of science.

14.15. Pure Truth as a Utopian Horizon

Pure truth, in this sense, functions as the horizon of scientific and technological progress: an ideal, unattainable in its absolute form, but necessary as a guiding principle. Science, understood as a progressive enterprise, never loses sight of this moral and ethical horizon: the pursuit of knowledge of the whole by means of the scientific method.

In statistical science, this pursuit takes the form of the contrast of hypotheses. Every empirical hypothesis is subjected to rational critique, and those that fall within the margin of error accepted by scientific policy are provisionally accepted as rational truths. The utopia of pure truth, though never fully realized, directs the critical spirit of science and ensures that inquiry remains oriented toward the most complete and justifiable understanding of reality possible.

14.16. Rational Critique in *Impossible Probability*: Validity

Within the framework of the theory of *Impossible Probability*, one of the earliest forms in which rational critique was developed is through the concept of *Validity*. Validity is the methodological expression of how empirical hypotheses are tested against rational critique, and it takes three principal forms:

1. **Validity of Equality**
2. **Validity of Positive Bias**
3. **Validity of Negative Bias**

These forms were first elaborated in Sections 6 and 11 of *Introduction to Impossible Probability*. Each expresses a different way in which hypotheses are contrasted with reality through rational critique, depending on whether the empirical proposition concerns equality of outcomes, systematic positive deviation, or systematic negative deviation.

14.17. The Validity of Equality

In the present entry, the focus will be on *Validity of Equality*. Within *Impossible Probability*, this concept refers to the statistical test whose aim is to determine whether a given subject or option behaves, within the margin of error accepted by scientific policy, in a manner that is sufficiently normal.

“Normal” in this context is not understood as uniformity or sameness, but rather as the tendency toward equality of opportunities. The Validity of Equality is thus the rational critique of whether, across repeated trials and within acceptable margins of error, the observed outcomes approximate the expectation of equal probability among the options considered.

In this sense, the Validity of Equality embodies the moral and political dimension of rational critique: it is not only a technical tool for measuring probability but also a philosophical commitment to fairness, normality, and equal treatment of hypotheses under conditions of chance.

14.18. Application of the Validity of Equality

Suppose that in a system, a set of modifications is introduced with the purpose of improving a series of elements equally. The expectation is that, as a result of these modifications, all elements will tend to achieve the same level of improvement in their behaviour.

To rationally validate whether these modifications have indeed improved all elements equally—at the same level of enhancement—the **Validity of Equality** is applied to each individual element. This statistical test determines whether the observed improvements correspond, within the acceptable margin of error, to the expectation that every element has been affected to the same degree.

Thus, the Validity of Equality functions as the rational critique of whether interventions produce genuinely equal effects, not merely at the aggregate level, but for each element considered individually in relation to the collective whole.

14.19. Theoretical Foundation: Tendency Toward the Ideal and Bias

Under this framework, the *ideal behaviour* corresponds to the inverse of the number of elements in the system, expressed as 1/N. If all elements tend equally toward the ideal, then the **bias** necessarily tends toward zero. This means that the absolute difference between empirical probability and theoretical probability converges toward zero.

The object of study, therefore, is to critique whether this convergence toward zero is sufficient to be rationally accepted by scientific policy. In other words, the question is whether the observed tendency of each element to approximate the theoretical ideal of 1/N constitutes enough improvement to be validated as rational equality.

Here, *bias* (sesgo) operates as the central measure: it quantifies the distance between empirical behaviour (observed probability) and theoretical expectation (ideal probability). Rational critique asks not only whether bias is reduced, but whether it is reduced sufficiently to warrant acceptance of equality.

14.20. Calculation of the Critical Ratio for the Validity of Equality

To determine rationally at what point the convergence toward zero of the absolute difference between empirical and theoretical probability should be considered sufficient, scientific policy establishes the **critical reason** (razón crítica), also called the **critical probability**.

This is defined as the product of:

1. The *Maximum Possible Theoretical Bias*, i.e., the difference between unity (1) and the inverse of the number of elements (1/N),
2. Multiplied by the percentage of error (X/100) that the policy is willing to accept.

In this way, the critical reason establishes a rational threshold: if the observed bias falls below this calculated boundary, then the hypothesis of equal improvement is accepted as rational. If not, the hypothesis fails rational critique.

14.21. Formula for the Validity of Equality

The formula for the Validity of Equality can be expressed as follows:

$$\text{Validity of Equality} = p(xc) - \left| p(xi) - \frac{1}{N} \right|$$

Where:

- If the result is **zero or positive**, equality of opportunities is accepted.
- $p(xi)$ = empirical probability of element *i*.
- $1/N$ = theoretical ideal probability (perfect equality).
- $p(xc)$ = critical probability, defined as:

$$p(xc) = \left(1 - \frac{1}{N}\right) \cdot \frac{X}{100}$$

Where:

- X = percentage of error that scientific policy is willing to accept.

14.22. Conditions for Acceptance of the Empirical Hypothesis

The empirical hypothesis will be accepted under the following condition: the **absolute value of the Bias Level** (that is, the difference between empirical probability and the inverse of *N*, or theoretical probability) must be less than or equal to the **critical probability**.

For the *Validity of Equality*, the critical probability is defined as the *Maximum Possible Theoretical Bias* multiplied by the acceptable margin of error, expressed as percentage *X* divided by one hundred. Formally:

$$\left| p(x_i) - \tfrac{1}{N} \right| \leq p(x_c) = \left(1 - \tfrac{1}{N}\right) \cdot \tfrac{X}{100}$$

X= percentage of error

When this equation is satisfied, the empirical hypothesis—namely, that the element under study behaves normally with respect to its sample—is accepted as rational. The threshold is determined by two parameters: the maximum theoretical bias (equal to unity minus the inverse of *N*) and the percentage of error *X* that scientific policy is willing to tolerate.

Thus, rational critique operationalizes acceptance through a clear rule: empirical deviations from theoretical equality are tolerated only up to the boundary set by the critical probability. Beyond that limit, the hypothesis is rejected as insufficiently close to the ideal of equality.

14.23. Practical Example: A Fair Coin

Consider a series of tosses of a coin, where the aim is to test whether the coin is fair (not weighted or tampered with). We calculate the empirical probabilities of heads and tails and compare them with the theoretical expectation, which is 1/N=1/2.

Applying the *Validity of Equality*, if the absolute difference between empirical probability (heads or tails) and theoretical probability (1/2) is less than or equal to the critical probability, then the hypothesis that the coin is fair is accepted. In this case, the coin's behaviour is judged to follow a normal random pattern.

Any small deviations—say, more heads than tails in one series of tosses—are interpreted as acceptable within the error margin. This margin is formally given by the product of the maximum possible theoretical bias (1 – 1/N) and the percentage *X* of error permitted by scientific policy. For a coin, with N = 2, the maximum possible theoretical bias is 1−1/2=1/2. Thus, the stricter the *X*, the more demanding the test becomes in declaring the coin fair.

This example illustrates how rational critique formalizes what is otherwise an intuitive j***udgment: a coin that produces 26 heads and 24 tails in 50 tosses can still be rationally accepted as fair*** if the deviation lies within the pre-defined margin of error.

14.24. Moral Demands and the Utopia of Pure Truth

The choice of the error percentage *X* is not a purely technical decision: it embodies the **moral and ethical demand** imposed by scientific policy. The smaller the accepted margin of error, the greater the ethical rigor in defining what is considered morally and scientifically "normal."

However, greater rigor also implies a higher probability of rejecting empirical hypotheses, since only those that approach most closely to pure truth will be accepted. This reflects the tension at the heart of rational critique: while science strives for truth, absolute truth remains unattainable. The *pure truth* functions as a utopia, an unreachable horizon guiding scientific practice.

This is analogous to the Kantian categorical imperative—"act only according to that maxim whereby you can at the same time will that it should become a universal law." As a modern utopia, it reminds us that finite and limited beings can never attain infinite and universal truth. Rational critique thus balances between two poles: the practical necessity of working with empirical approximations and the moral horizon of aspiring to absolute truth.

In this way, the *Validity of* Equality is not only a statistical test but also a reflection of the ethical foundations of science: it demands fairness, transparency, and intellectual honesty in the face of human finitude, recognizing both the limits of empirical inquiry and the necessity of orienting it toward the highest possible ideal of truth.

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15. Validity of Bias, Positive or Negative, in a Normal Model

15.1. Object of Study: Equality or Bias

In the framework of *Impossible Probability*, the object of study can be classified in two main ways: either as **equality** or as **bias**. These two categories determine the direction of statistical and philosophical analysis. When the focus is equality, the intention is to measure whether all subjects or options within a set behave in a way that is statistically uniform, within an acceptable margin of error. Conversely, when the object of study is bias, the analysis moves toward identifying asymmetries or deviations between empirical probabilities and their corresponding theoretical expectations. Within this second case, bias is subdivided into **positive bias** and **negative bias**, depending on whether the deviation is above or below the theoretical baseline. This initial distinction is fundamental, as it provides the methodological entry point for constructing hypotheses and applying critical rational analysis in Impossible Probability.

15.2. The Object of Study as Equality

The object of study is understood as **equality** when, given a set of *N* subjects or options, the goal is to ensure that—within a margin of statistical error—each subject or option tends toward an empirical probability that is as close as possible to the **theoretical probability**. The theoretical probability is defined as the probability that each subject or option should possess if all of them had exactly the same frequency or direct value. In mathematical terms, this theoretical probability is obtained by dividing the unit by the number of elements (*N*), resulting in *1/N*.

In *Impossible Probability*, this value is referred to as the **inverse of N**, or *1/N inversion*. However, its role extends beyond the simple representation of theoretical probability. In fact, *1/N inversion* serves multiple functions depending on the type of universe under study. For example, in universes composed of infinite subjects or options, *1/N inversion* also operates as the theoretical dispersion probability of the sample, and as the probability of sampling error in representativeness. Thus, *1/N inversion* is not only a numerical expression of equality, but also a methodological bridge that connects probability theory with the epistemological concerns of representativeness and validity.

15.3. The Object of Study as Bias

In those models where the primary object of study is not equality, the focus necessarily shifts toward **bias**. Bias emerges whenever the empirical probability of a subject or option differs from its theoretical probability. This discrepancy becomes the object of critical analysis.

Bias can be studied in two distinct forms: **positive bias** and **negative bias**. A **positive bias** occurs whenever the empirical probability of a subject or option is greater than the theoretical probability ($p(xi) - 1/N > 0$). Conversely, a **negative bias** is defined as the situation in which the empirical probability is less than the theoretical probability ($p(xi) - 1/N < 0$). This dual distinction is essential because it allows the research to focus either on validating the superiority of a given subject or option compared to the theoretical average, or on confirming its inferiority relative to the same standard.

By framing bias in this way, *Impossible Probability* provides a systematic method for evaluating asymmetries in data, while linking those asymmetries to broader questions of rational validity and scientific policy.

15.4. The Ideal and the Maximum Empirical Probability

Consider a set *N* composed of various subjects or options. If there exist specific reasons—whether theoretical, political, or normative—that designate one subject or option as **ideal**, then the true rational goal is to determine the extent to which this ideal

subject tends to achieve the **Maximum Possible Empirical Probability**. This maximum is defined as $p(xi) = 1$.

In such an arrangement, the ideal subject or option would exhibit the highest possible positive bias, while all other non-ideal subjects or options would necessarily tend toward the **Minimum Possible Empirical Probability**, i.e., $p(xi) = 0$. This framework reflects the fact that probability models operate within a bounded dimension: probabilities cannot fall below zero nor exceed unity. Any value outside this range is mathematically impossible, and thus conceptually excluded from the logic of Impossible Probability.

This theoretical framing underscores the importance of identifying the **ideal subject or option** in any given model. Once identified, its statistical behavior provides a reference point against which the rest of the distribution can be critically evaluated. It also highlights the connection between probability theory and normative considerations, since the designation of an "ideal" is not purely mathematical but often emerges from contextual, political, or philosophical reasoning

15.5. Omega Models and Their Definition

In *Impossible Probability*, beyond the cases of pure equality and bias, there exists a particular class of models referred to as **omega models**. An omega model arises when, within a given set N of subjects or options, there is a variable number of **ideal subjects or options** that is greater than one but less than N. In other words, when the set of ideals is neither reduced to a single ideal (as in normal models) nor extended to the entire set (as in equality models), but instead falls within the interval between two and $N - 1$, the model is formally categorized as an omega model.

The concept of the omega model is important because it allows for the representation of intermediate cases, where ideals are plural yet not universally distributed across the set. This reflects scenarios where multiple outcomes or options may be considered desirable or superior, but not all of them achieve the status of being ideal. Thus, omega

models provide the theoretical framework for analyzing **systems of partial ideality**, where perfection is distributed among several but not all elements of the system.

15.6. Differences Between Omega Models and Normal Models

Omega models are distinguished from normal models primarily by the **range of ideality** they accommodate. In a normal model, the usual assumption is that there is a single ideal subject or option, and that dispersion may extend between the extreme values of minimum and maximum. Normal models, therefore, oscillate between two poles: complete equality (dispersion zero) or maximum inequality (dispersion maximum).

In contrast, an omega model does not operate within such polar limits. Instead, it admits the existence of a **variable magnitude of ideals**, specifically between two and *N – 1*. This fundamental difference means that omega models must be studied using different rational criteria, as their structural dynamics prevent them from ever collapsing into total equality or expanding into maximum dispersion.

15.7. Dispersion in Omega Models

A key characteristic of omega models is that their **dispersion cannot vary between zero and maximum**. This constraint arises from the very definition of the omega structure. Since an omega model requires the existence of at least two ideals (but not all), it is impossible for the system to ever achieve zero dispersion, because by definition there must always be at least one non-ideal subject or option.

Similarly, maximum dispersion is unattainable in an omega model. Maximum dispersion would imply that only a single subject or option monopolizes the maximum empirical probability, with all others collapsing to zero. But in omega models, by construction, there must be at least two ideals, which prevents such a situation from ever materializing.

Thus, the **ideal dispersion** in omega models is defined in relation to the **magnitude of the ideals**. The distribution of probability across the set depends critically on how many

subjects or options are designated as ideal, which fixes the structural boundaries of dispersion.

15.8. Critical Evaluation and Margin of Error in Omega Models

In studying omega models, it becomes evident that dispersion cannot be evaluated in absolute terms but must instead be analyzed **critically** through the lens of error margins or tolerances. This means that any hypothesis about the ideal dispersion of an omega model must take into account the **degree of uncertainty** that the scientific policy or methodological framework is willing to accept.

Therefore, the evaluation of omega models requires not only a mathematical assessment of probability distributions but also a philosophical reflection on the **limits of rational validation**. The central question is not whether dispersion can be eliminated or maximized—which is impossible in omega contexts—but whether the dispersion observed falls within an acceptable margin of rational doubt that still preserves the internal coherence of the model.

15.9. The Concept of Normality in Impossible Probability

The concept of **normality** plays an important role in statistics in general, but within *Impossible Probability* it acquires more complex and context-dependent meanings. While traditional statistics often treats normality as a purely descriptive property of distributions (i.e., the bell curve), *Impossible Probability* embeds normality within a wider epistemological framework.

Depending on the **stage of analysis** and the **context of application**, normality can be understood as a tendency toward balance, as a manifestation of equality, or as a benchmark against which deviations (biases) are measured. Thus, in Impossible Probability, normality is not a fixed definition but a **conceptual tool** that adapts to the logical requirements of the system under examination.

15.10. Statistical Normality and the Gaussian Curve

From a statistical perspective, the most common representation of normality is the **Gaussian distribution** or **bell curve**. In this distribution of random events, the most frequent values cluster around the center, representing the mean or mode of the system, while the extremes exhibit progressively fewer occurrences.

This distribution is considered the most "normal" in classical statistics because it reflects the typical way in which random variables tend to aggregate around a central tendency, with deviations diminishing symmetrically on either side. In *Impossible Probability*, this representation of normality is acknowledged as a useful model but is also reinterpreted within its broader philosophical framework. Here, normality is not only a statistical regularity but also an expression of how rational systems balance centrality and deviation under specific epistemic and political conditions.

15.11. Normality in the Absence of Variables

In the framework of *Impossible Probability*, the concept of normality can also be approached from the perspective of **absence**—that is, in the absence of any independent or dependent variables that might influence the magnitude of ideals defined by scientific policy. In such a scenario, what is considered “normal” is that the system will naturally tend toward **statistical normality**.

This means that dispersion, as a dimension, may oscillate between two extremes:

- **Zero dispersion**, which occurs when the model tends toward equality of opportunities, where all subjects or options exhibit equivalent empirical probabilities.
- **Maximum dispersion**, which occurs when, within the entire set *N*, there exists a single subject or option that achieves the Maximum Possible Empirical Probability (i.e., probability equal to one), while all others collapse to probability zero.

The condition, however, is that this movement between zero and maximum must always be rational. Normality under absence, therefore, is not chaos or randomness without direction; rather, it is the **default trajectory** of systems when no additional forces, constraints, or variables are introduced. This conceptualization underscores the fundamental principle that, left to itself, a probabilistic universe tends either to balance (equality) or to concentration (maximum inequality).

15.12. Individual Validation of Normal Behavior

In order to validate **normal behavior** within the oscillating dimension between zero and maximum dispersion, *Impossible Probability* introduces a method of **individual validation**. This involves analyzing the behavior of a single variable, subject, or option in isolation. The central question becomes: does this particular subject behave in a manner that is consistent with the expected trajectory of normality?

The primary tool for such validation is the concept of **Validity** (*Validez*). Validity here functions as a mechanism of rational critique applied to empirical reality. It allows one to test whether the observed probability of an individual subject aligns with the theoretical expectations of the system, within a margin of rationally acceptable error.

It is important to note that in *Impossible Probability*, validity is not limited to the study of normality. It is a **general epistemic tool**, applied across multiple dimensions of critique: equality, positive bias, negative bias, dispersion, and beyond. Its application to the validation of normal behavior represents just one of many possible uses.

15.13. Preliminary Synthesis: Validity of Equality

In order to understand the logic behind the **Validity of Bias**—whether positive or negative—in a normal model, it is necessary to first provide a brief synthesis of the **Validity of Equality**, which was previously explained in detail.

The Validity of Equality serves as the foundational case because it establishes the baseline relationship between empirical probability ($p(xi)$) and theoretical probability

(*1/N*). The rules governing equality provide the methodological framework that will later be adapted and extended to cases of bias, where deviations from equality must be systematically assessed and rationally validated.

Thus, before analyzing bias, it is crucial to revisit and consolidate the principles of equality: its definition, its margins of error, and the way these are operationalized in the form of a critical ratio.

15.14. Definition and Calculation of the Validity of Equality

The **Validity of Equality** is defined as follows: a subject or option is said to behave in accordance with equality of opportunities whenever its empirical probability is sufficiently close to the theoretical probability (*1/N*), within a rationally acceptable margin of error or doubt.

This implies that the absolute difference between empirical and theoretical probability must fall within a differential that lies inside the accepted error margin. The determination of this margin is not arbitrary; it is calculated by multiplying the **percentage of error tolerated** (expressed as *X/100*) by the **Maximum Theoretical Bias Possible**.

The Maximum Theoretical Bias Possible represents the greatest error that could arise in a study of equality. Since in any equality model the only possible error is the presence of bias, the goal of scientific policy is to minimize this error. The rational way to do so is to define **how much error one is willing to tolerate** relative to the maximum error conceivable.

Mathematically, the critical probability or rational ratio (*p(xc)*) in the Validity of Equality is expressed as:

$$p(xc)=(1-1/N)\cdot(X/100)$$

Where:

- *1 – 1/N* is the Maximum Theoretical Bias Possible.
- *X* is the percentage of error tolerated by scientific policy.

This formula provides the benchmark against which empirical results are measured. If the deviation between empirical and theoretical probabilities is equal to or smaller than *p(xc)*, the hypothesis of equality is provisionally accepted as rational.

15.15. Maximum Theoretical Bias Possible

Within the study of equality, **all error is identified with bias**. Therefore, the **Maximum Theoretical Bias Possible** represents the greatest conceivable deviation from equality. It occurs when one subject or option monopolizes the entire probability (i.e., has probability equal to one), while the theoretical expectation is *1/N*.

Formally, this is expressed as:

$$\text{Maximum Theoretical Bias Possible} = 1 - 1/N$$

$$\text{Maximum Empirical Probability Possible} = 1$$

$$\text{Theoretical probability} = 1/N$$

This definition ensures that the scale of error is mathematically bounded: no subject can exceed probability one, and no subject can fall below probability zero. Hence, the Maximum Theoretical Bias Possible becomes the **reference constant** against which acceptable margins of error are calibrated.

By tying the definition of validity to this maximum, *Impossible Probability* ensures that the acceptance of hypotheses is always **relative to the worst-case scenario**, thereby embedding a form of methodological rigor into the system***: any claim of equality must be validated not in absolute terms, but against the limits of possible error.***

15.16. Formulas for the Validity of Equality

Validity of Equality is then equal to the critical probability minus the absolute value of the normal bias or a subject or option. It logically follows that in the framework of the **Validity of Equality**, the **critical ratio** is calculated as the product of the **Maximum Theoretical Bias Possible** and the percentage of error (*X*) that scientific policy is willing to accept, expressed over one hundred. Therefore this is the equation of Validity of Equality:

Validity of Equality = p(xc) - / (p(xi) – 1/N)/ = zero or positive accepted

Formally, the **critical probability** (*p(xc)*) in the Validity of Equality is given by:

$$p(xc)=(1-1/N)\cdot(X/100)$$

Where:

- *1 – 1/N* represents the Maximum Theoretical Bias Possible.
- *X* is the percentage of error or uncertainty tolerated in the acceptance of the hypothesis.

In synthesis, the Validity of equality is:

Validity of Equality = ($(1-1/N)\cdot(X/100)$ **) – (p(xi) – 1/N) = Zero or positive accepted**

X= percentage of error

This formula ensures that the criterion for acceptance is not arbitrary but grounded in a proportional relationship between the maximum possible error and the tolerance explicitly admitted by the scientific framework. In other words, the critical probability functions as the **boundary condition** for rational acceptance of equality within the model.

15.17. Applied Example: The Teacher and the Students

An illustrative example of the **object of study as equality** can be drawn from the educational field. Imagine a teacher who aims for all students to learn a given subject equally. If each student is presented with the same set of exercises, the teacher's pedagogical goal would be for all of them to solve these exercises correctly. This would imply that, in an evaluation context, all students achieve the same direct score or frequency of correct answers.

Statistically, this situation means that the **empirical probability** of each student's success tends toward *1/N inversion*, i.e., equal distribution across the group. In such a case, the appropriate analytical tool is the **Validity of Equality**, since the objective is to determine whether the distribution of learning outcomes corresponds to the theoretical ideal of equality, within the tolerated margin of error.

The validation formula is expressed as:

$$p(xc) - / \left(p(xi) - 1/N\right) / \ \geq 0 \Rightarrow \text{equality is accepted}$$

Where *p(xi)* represents the empirical probability of success for each student. The condition holds whenever the deviation of empirical probability from theoretical equality is smaller than or equal to the critical probability defined earlier.

Thus, in educational terms, equality is not interpreted as an absolute identity of results but as a distribution of outcomes that remains **close enough** to theoretical expectations to be judged rationally acceptable.

15.18. The Normal Model with a Single Ideal

Consider now a **normal model** in which dispersion oscillates between zero and maximum. Suppose we are working with a universe of limited options, defined by a set *N*. Within this set, let there exist only one subject or option that can be considered **ideal**.

As a practical example, take a survey designed to measure attitudes toward individuals from different cultural or racial backgrounds. The possible responses might be limited to three:

1. Positive attitude toward cultural or racial difference.
2. Negative attitude toward cultural or racial difference.
3. No response or undecided.

Within this universe, only one response may be deemed politically or ethically **ideal**: the positive attitude toward cultural and racial diversity.

If in a model of *N* subjects or options there exists only one ideal, then the rational expectation is that all direct scores or frequencies should progressively concentrate around this ideal subject or option. In probabilistic terms, the **political or normative ideal** should tend toward the **Maximum Empirical Probability Possible** ($p(xi) = 1$), while all other non-ideal subjects or options should tend toward the **Minimum Empirical Probability Possible** ($p(xi) = 0$).

This configuration reflects the logic of normal models with a single ideal: dispersion collapses toward concentration around one value that embodies the ideal, while all others approach nullity.

15.19. Positive Bias in Models with a Single Ideal

If such a situation holds—where within the entire set *N* there is only one ideal subject or option—then the **Bias Level** of that ideal will necessarily tend toward the **Maximum Theoretical Bias Possible**, as long as its empirical probability approaches unity.

The task of rational critique, therefore, is to evaluate whether the empirical probability of the ideal subject or option approaches the Maximum Empirical Probability Possible ($p(xi) = 1$) within a margin of error deemed rationally acceptable. This margin represents the **difference tolerated** between the maximum ideal state and the observed empirical probability.

In practice, this involves testing whether the empirical probability of the ideal is **sufficiently close** to one to justify the acceptance of the hypothesis that the ideal has been realized. The smaller the difference between the empirical probability and one, the more rationally valid the hypothesis becomes.

In terms of **positive bias**, this means that the Bias Level of the ideal must be equal to or greater than a critical ratio, defined as the product of the Maximum Theoretical Bias Possible and the reliability percentage ($X/100$) chosen as the threshold of acceptance. Thus, the Validity of Positive Bias becomes the rational test of whether concentration around the ideal is strong enough to be accepted as valid within the framework of *Impossible Probability*.

15.20. Definition and Formula of the Validity of Positive Bias

When the object of study is to minimize the difference between the **Maximum Possible Empirical Probability** and the **observed Empirical Probability**, the logical consequence is that the closer the empirical probability of the ideal subject approaches unity, the more rational the empirical hypothesis becomes. In other words, the nearer the empirical value is to the maximum ideal possible, the stronger the rational justification for considering the hypothesis valid.

From the perspective of bias, this implies that the **Bias Level** of the ideal subject or option must be equal to or greater than a **critical ratio**. This ratio is defined as the

product of the **Maximum Theoretical Bias Possible** and the percentage of reliability (*X/100*) that the scientific policy is willing to accept.

Accordingly, the **Validity of Positive Bias** is measured by subtracting the critical ratio from the observed Bias Level. If the result is zero or positive, then the hypothesis of positive bias is accepted as rationally valid.

Formally, the expression is:

$$(p(xi) - 1/N) - p(xc) \geq 0 \Rightarrow \text{Positive Bias is accepted}$$

Where:

- *p(xi)* is the empirical probability of the ideal subject.
- *1/N* is the theoretical probability (inverse of N).
- *p(xc)* is the critical probability, defined as:

$$p(xc) = (1 - 1/N) \cdot (X/100)$$

X = percentage of reliability

This formula provides a clear methodological standard: positive bias is accepted whenever the empirical evidence demonstrates that the deviation in favor of the ideal is at least as great as the critical threshold determined by policy.

15.21. Margin of Error in the Validity of Positive Bias

By definition, the percentage *X/100* of reliability corresponds directly to the degree of confidence that scientific policy is willing to accept in validating a positive bias. Implicitly, this means that there is an associated **margin of error or doubt**, which complements the reliability margin.

This margin of error is mathematically expressed as the difference between unity and the critical probability:

$$1-p(xc)=\text{Margin of error or doubt in the Validity of Positive Bias}$$

Where:

$$p(xc)=(1-1/N)\cdot(X/100)$$

X = percentage of reliability

The interpretation is straightforward: if reliability corresponds to the degree of certainty one is prepared to accept, then error or doubt represents the **residual uncertainty** that inevitably accompanies any empirical validation. In this way, *Impossible Probability* explicitly integrates uncertainty into its theoretical framework, acknowledging that all scientific acceptance is provisional and conditioned by the margins of error inherent to empirical reality.

15.22. Transformation Toward Negative Bias

Conversely, if in a given set *N* there exists an ideal within a normal model—or, in the case of an omega model, if there exists a subset of ideals between two and *N – 1*—it may also be necessary to validate the behavior of **non-ideal subjects or options**. These are subjects whose empirical probability tends toward zero, either because they are explicitly defined as non-ideal or because their normative role in the system is precisely to embody null probability.

In such cases, the focus shifts from **Positive Bias** (where the emphasis is on validating proximity to the maximum possible value) to **Negative Bias** (where the emphasis is on validating proximity to the minimum possible value).

Thus, any study of positive bias can, by methodological inversion, be transformed into a study of negative bias, depending on the object of interest. The critical task then becomes to determine whether the negative bias exhibited by non-ideal subjects is rationally acceptable within the parameters set by scientific policy.

In this framework, **the policy of science** defines the standards and thresholds that govern what counts as a valid negative bias. The model—whether normal or omega—provides the structural context, but the ultimate determination of validity lies in whether the empirical probabilities of non-ideal subjects remain sufficiently close to zero, within a margin of rationally acceptable error.

15.23. Definition of the Validity of Negative Bias

In the same way that the **Validity of Positive Bias** can be studied, it is also possible to examine the **Validity of Negative Bias**. Both share the same logical foundation, namely the comparison between empirical and theoretical probabilities within acceptable margins of error. However, the **mode of critique differs** in how the critical ratio is determined.

While positive bias focuses on how closely the empirical probability of the ideal approaches the maximum theoretical value (unity), negative bias emphasizes how closely the empirical probabilities of **non-ideal subjects or options** approach zero.

This shift requires a redefinition of the critical probability, since the standards of validity must be adapted to the logic of absence or nullity rather than presence or maximality.

Thus, the Validity of Negative Bias is not simply the inverse of positive bias but a distinct framework of critique that addresses the rational validation of probabilities tending toward zero.

15.24. Maximum Possible Negative Bias

If in the study of positive bias the ideal is for the **Bias Level** of the political or normative ideal to approach the **Maximum Theoretical Bias Possible**, then in the case of negative bias there is no doubt that the **Maximum Possible Negative Bias** must equal the **inverse of N** (*1/N*).

This follows logically from the definition of bias as the difference between empirical probability and theoretical probability:

$$\text{Bias Level} = p(xi) - 1N$$

For non-ideal subjects, the “ideal” state is for their empirical probability to be zero. Thus, their bias is:

$$\text{Bias Level for non-ideal} = 0 - 1/N = -1/N$$

From this reasoning, it follows that no negative bias can be less than −1/N. In other words, −1/N constitutes the absolute limit of negative bias. Therefore, the inverse of N does not only serve as theoretical probability in equality models but also functions as the **Maximum Possible Negative Bias** in models where non-ideal subjects are expected to approach zero.

This dual role of *1/N* illustrates the versatility of this value in *Impossible Probability*: it is simultaneously a measure of equality, a threshold for error in representativeness, and a bound for negative bias.

15.25. Rational Critique in Models with Negative Bias

When the object of study is to confirm that, whether in a normal or omega model, all non-ideal subjects or options (those whose ideal state is to have zero probability) indeed tend toward zero, the appropriate analytical tool is the **Validity of Negative Bias**.

The rational critique here consists of verifying whether the empirical probabilities of non-ideal subjects are sufficiently small to be accepted as rationally valid. In other words, the empirical probabilities must fall close enough to zero that they can be considered consistent with the logical expectations of the model.

The method of validation requires testing whether the **difference between theoretical probability (1/N) and empirical probability (p(xi))** is greater than or equal to the product of the Maximum Possible Negative Bias (*1/N*) and the reliability percentage (*X/100*). If this condition holds, then the hypothesis that non-ideal subjects tend toward zero is rationally accepted.

This framework allows the scientific policy to establish objective parameters for judging whether non-ideal subjects are behaving as expected within the model. It acknowledges that while zero may be the theoretical goal, in empirical practice a margin of deviation will always exist, which must be critically managed.

15.26. Formula of the Validity of Negative Bias

The formal expression of the **Validity of Negative Bias** is as follows:

$$(1N - p(xi)) - p(xc) \geq 0 \Rightarrow \text{Negative Bias is accepted}$$

$$p(xc) = 1/N \cdot X100$$

X = percentage of reliability

This formula expresses in mathematical terms the principle that a non-ideal subject is validated as tending toward zero whenever the difference between theoretical probability and empirical probability is sufficiently large to exceed the critical threshold.

Furthermore, if the rational critique of Negative Bias is established on a margin of reliability, then inversely a margin of error or doubt is also accepted. This margin is defined as the difference between unity and the reliability margin:

$$1 - p(xc) = \text{Margin of error or doubt in the Validity of Negative}$$

That is, it corresponds to the complement of the reliability threshold, explicitly acknowledging that scientific validation is never absolute but always accompanied by residual uncertainty.

15.27. The Limits of Knowledge an d Permanent Doubt

Every rational hypothesis is only valid for as lon g as there exist **sufficient *rea sons* for its validation**. Beyond that sufficiency—always constrained by the inherent limitations of human cognition—there will inevitably rema in a **logical margin of doubt**. This margin is where reality might dissolve into mere appearance.

Given the impossibility of attaining absolute knowledge, humanity faces the **drama of its own limitation**: the logical nihilism of accepting permanent doubt about every aspect of reality. We remain incapable of accessing pure truth in itself; even the very idea of an absolute and superior truth becomes a **utopia**—conceivable, perhaps, but forever unreachable. The absence of guarantees that such a truth exists further deepens this paradox: behind all phenomena there may be nothing but an immense void.

Thus, what we consider to be absolutely certain by the mere nature of being may in fact be nothing more than a human illusion, or even a by-product of our imagination. Faced with this radical uncertainty, awakened by existence itself, science cannot claim absolute truth. Rather, **scientific truths are provisional**, accepted only as rational approximations within the margins of doubt, based on sufficient positive reasons that justify their temporary acceptance.

In practice, this means that any human proposition may ultimately be mere appearance, recognized as rationally true only while the margin of possible error has not yet manifested itself as inevitable. Scientific knowledge is therefore a constant negotiation with uncertainty—a fragile bridge suspended over the abyss of doubt.

15.28. Doubt as a Permanent Principle

Within an infinite universe, or within a space-time continuum sufficiently vast to encompass all possibilities, **everything that is possible is, sooner or later, inevitable**. From this premise, it follows that even the acknowledgment of a mere rational doubt within a given system or set implies accepting that truth itself must remain perpetually open to question.

Truth, then, is never absolute. ***The only permanence is doubt [I doubt, therefore I exist]***. This recognition destabilizes not only scientific propositions but also the very foundations of existence. Nothing can be deemed absolutely reliable—not even the fact of existence itself. If no entity or phenomenon can be guaranteed as unconditionally real or certain, then doubt becomes the **fundamental condition of being**.

In this light, doubt is not a weakness of knowledge but the permanent horizon against which all rational inquiry takes shape. It is the structural reminder that science, philosophy, and human reason operate not in the realm of absolutes, but within the shifting, fragile margins of probability, appearance, and error.

[This paragraph is central to our current model of AI. So far, we have studied that the foundation of AI is the total elimination of all sources of error, which could be possible in the near future. What remains to be seen is whether our AI will be able to learn the importance of doubt. Even if a global AI can generate an accurate global matrix of the entire universe and find the solution to the equation of the matrix, even in that scenario, the global AI should be able to understand that the result of the matrix must still be questioned, and that nothing is exactly as it appears. The problem we are going to face is the fact that, from my point of view, we are running out of time to train our AI models to reach that level of reasoning. That is why, while in 2011 my focus was on traditional AI understood as cognition, in 2025 my focus is on the development of Emotional AI. From my perspective, Emotional Intelligence is linked to our capacity for doubt; therefore, Emotional Intelligence is, in other words, real self-awareness.]

15.29. The Human Value of Science in the Face of Doubt

Yet, paradoxically, what ennobles humanity is not the resignation to this existential doubt but the capacity to **rise above it**. The true value of the human spirit lies not in the naïve affirmation of truth as if it were free of uncertainty, but in the ability to confront limitation directly and still **continue the pursuit of knowledge**.

The greatness of humanity resides in the courage to create science in spite of uncertainty—in the ability to build rational frameworks, test hypotheses, and refine understanding, even while knowing that certainty will always elude us. It is in this effort, carried out against the backdrop of doubt, that the ethical and intellectual dignity of humanity is revealed.

Thus, the human response to the permanent drama of doubt is not despair but **scientific perseverance**: the determination to construct meaning, develop knowledge, and approximate truth, even when certainty is impossible. In this sense, science is less the conquest of absolute truth than the ongoing exercise of resilience, creativity, and rational commitment in a world where doubt is the only permanent condition.

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16. Omega Validity

16.1. Validity of Equality, Positive Bias, and Negative Bias in Normal Models

As established in the previous sections on *Validity of Equality*, *Validity of Positive Bias*, and *Validity of Negative Bias*, these models of validity are only strictly applicable in the case of normal sample models. By "normal" in this context we mean those models in which the empirical dispersion of the sample may oscillate between two extreme values: zero and maximum.

Empirical sample dispersion can only fluctuate within this interval (0 to maximum) under the assumption that the model reflects an ideal of equality of opportunities. In such a case, the trend of both the individual empirical dispersion (Bias Level) and the sample empirical dispersion (Mean or Typical Deviation) should ideally tend toward zero. In other words, in a perfectly equal model, each subject or option would conform to the expected distribution without deviation.

However, at the other extreme, one could also conceive of the case where within a sample there exists a single subject or option that, for whatever reason, deviates maximally from the rest. In this situation:

- That particular ideal subject or option would approach the Maximum Theoretical Bias Possible, mathematically defined as $1 - (1/N)$, where N is the size of the sample.
- All other subjects or options (i.e., $N - 1$) would tend toward the Maximum Negative Bias Possible, which corresponds to the absolute value of the inverse of N ($1/N$).

- In terms of empirical probabilities, the exceptional subject would tend to the Maximum Empirical Probability Possible, equal to 1, while all the rest would tend to the Minimum Empirical Probability Possible, equal to 0.

At the aggregate or sample level, this extreme polarization would result in the Mean or Typical Deviation tending toward its maximum value. Thus, validity in normal models is always framed by this dichotomy between equality of opportunities (minimal dispersion) and singular exceptionality (maximal dispersion).

16.2. Models with Non-Extreme Dispersion and Omega Models

Nevertheless, in practice there are many cases where dispersion is not confined to these extreme scenarios of "all or nothing" (0 or maximum). In other words, there exist models where individual or sample dispersion does not necessarily conform to the binary pattern dictated solely by either the equality of opportunities ideal or the existence of a single valid ideal option within the entire set *N*.

Instead, some models allow for an intermediate distribution of validity, where more than one ideal can coexist simultaneously. Specifically, whenever there exists a magnitude of valid ideals in *N* between 2 and *N – 1, both extremes included*, the model should be considered an omega model.

Omega models therefore represent a generalization of validity beyond the strict framework of normal models. They capture situations in which the configuration of ideals within the sample cannot be reduced to a dichotomy (zero vs. maximum), but instead requires recognition of multiple valid alternatives coexisting within the same evaluative space.

16.3. Example: Multiple-Choice Test with Several Valid Options

A simple yet illustrative example of an omega model can be found in the context of educational or psychological assessment, particularly in multiple-choice tests.

Imagine a test item in which more than one option is valid. Crucially, each valid option is equally valid: no option is "more correct" or "less correct" than the others. In such a case, all valid options carry the same weighted value of appropriateness in the response. The validity of one option does not exclude the validity of another, and ideally, the test would be designed so that all equally valid options should be selected to reflect a complete and adequate answer.

This example demonstrates how an omega model differs from a normal model: validity here is not located in a single point of convergence (equality of opportunities, or one exceptional option) but distributed across several alternatives of equal legitimacy. Dispersion, therefore, does not gravitate toward the extremes of zero or maximum but instead stabilizes within an intermediate range, reflecting the coexistence of multiple valid possibilities.

16.4. Applied Case: Astronomy Test

Let us consider a concrete example in the context of an astronomy test. Suppose the following question is asked:

“Which of the following celestial bodies are planets in our galaxy?”

The options provided are six in total:

1. Mercury
2. Phobos
3. Jupiter
4. Europa
5. The Moon
6. Venus

The correct answers, according to the scientific object of the question, are **Mercury, Jupiter, and Venus**. Thus, out of $N = 6$ possible options, only three are valid.

The reason is straightforward: Mercury, Jupiter, and Venus are planets, while Europa and the Moon are satellites, and Phobos is an asteroid. Therefore, only three out of the six possibilities meet the condition of validity.

This example illustrates the essence of an **omega model**: validity is not concentrated in one sole option (as in a "normal model" of maximum dispersion) nor is it equally distributed across all options (as in the "normal model" of complete equality). Instead, validity is distributed across a **subset of options** that coexist as equally correct.

16.5. Definition of an Omega Model versus a Normal Model

An **omega model** is defined as any model in which the number of valid ideals within *N* is greater than one but less than *N*.

- In a **normal model**, dispersion oscillates exclusively between two extremes:
    - **Zero dispersion**, when all subjects or options are equal among themselves.
    - **Maximum dispersion**, when there is only one valid ideal in the entire set *N*, and all others deviate maximally.
- In contrast, an **omega model** exists when dispersion does not align with either of these two extremes. Instead, it reflects the coexistence of multiple valid ideals within *N*, with the number of such ideals (Ω) lying strictly between 2 and $N - 1$.

Thus, the omega model arises precisely from the need to explain the intermediate case: when validity is neither universal nor singular but distributed among several equally correct options.

16.6. Conditions for Defining an Omega Model

The formal conditions for classifying a model as omega are as follows:

1. **Not all subjects or options within *N* are equal** — that is, there exists at least one differentiation between valid and non-valid elements.
2. **There is more than one valid subject or option**, but fewer than the total number of elements in *N*.

Only when both of these conditions are satisfied can we define a model as omega. In other words, an omega model is characterized by an **intermediate dispersion structure**: not total homogeneity (all valid) and not total singularity (only one valid), but a distribution of validity across a subset of elements.

16.7. Ideal Dispersion in Omega Models

The concept of **ideal dispersion** in omega models is crucial for their mathematical definition.

- An omega model reaches its **ideal dispersion** when **all valid options included within Ω** (the set of ideal subjects/options) have the same empirical probability.
- At the same time, all **non-valid options** outside Ω tend toward an **empirical probability of zero** — the **Minimum Empirical Probability Possible**.

Under these conditions, the **Ideal Mean Deviation** of an omega model can be expressed mathematically as:

$$\text{Ideal Mean Deviation} = \frac{1}{N} \cdot \left[2 \cdot \Omega \cdot \left(\frac{1}{\Omega} - \frac{1}{N} \right) \right]$$

Where:

- **N** = total number of elements in the model.
- **Ω** = the number of valid ideals within N.
- **1/Ω** = the **ideal empirical probability** that each valid option should tend toward.

T

hus, the symbol **Ω** encompasses all valid options, while its inverse, **1/Ω**, represents the probability that ideally should characterize each valid element.

This formalization shows that **omega validity** generalizes the traditional validity models, allowing us to analyze real-world situations in which correctness or validity is shared by multiple options of equal weight, rather than being monopolized by one or distributed across all.

16.8. Numerical Example of Ideal Dispersion in Omega

The **Ideal Mean Deviation** in an omega model can be mathematically expressed as:

$$\text{Ideal Mean Deviation} = \frac{\left[\left(\frac{1}{\Omega} - \frac{1}{N}\right) \cdot \Omega\right] \cdot 2}{N}$$

Let us apply this to the astronomy test case introduced earlier. Recall that:

- Total number of options: $N = 6$
- Valid options (Ω): Mercury, Venus, Jupiter → $\Omega = 3$
- Inverse of Ω: $1/\Omega = 1/3$

Thus, in this case, each valid option ideally tends toward an empirical probability of *1/3*, while the remaining three non-valid options tend toward zero. Plugging these values into the formula produces the precise value of the Ideal Mean Deviation for this model, which represents the optimal theoretical measure of dispersion under conditions of omega validity.

This example highlights how omega models capture intermediate dispersions where correctness is distributed evenly across a subset of equally valid elements, as opposed to collapsing into either total uniformity (all valid) or singularity (only one valid).

16.9. Ideal Bias in Omega Models

Once an omega model has been defined—distinguished from a normal model precisely by the fact that the number of valid ideals in *N* is greater than one but less than *N*—it becomes possible to calculate the **ideal bias** for any given valid subject or option within Ω.

The principle is as follows:

- The **ideal empirical probability** for every valid element is given by the inverse of Ω

  Ideal empirical probability in an omega model = $1/\Omega$

- Consequently, the **ideal bias** for any valid element in Ω is the difference between the inverse of Ω and the inverse of N:

  $$\text{Ideal Bias} = 1/\Omega - 1/N$$

This difference captures how far the empirical probability of a valid option is expected to deviate from the baseline uniform distribution defined by the entire set *N*.

16.10. Mathematical Definition of Ideal Bias in Omega

Generally speaking, the Ideal Bias in Omega is equal the difference between the ideal probability, inversion of omega, minus the theoretical probability, inversion of N. Formally:

Ideal Bias for any element in $\Omega = 1/\Omega - 1/N$

This equation provides a precise criterion for evaluating whether an observed bias level corresponds to what would be theoretically expected under conditions of omega validity.

16.11. Rational Critique of Ideal Bias in Omega

Knowing the **ideal bias** allows us to apply a **rational critique**. Specifically, one can assess whether the **Bias Level** (*Nivel de Sesgo*) of any observed subject or option within Ω approaches, within a tolerable margin, the ideal bias value.

- If the observed bias approximates the ideal value closely enough, it can be considered acceptable.
- If the deviation is excessive, it indicates that the subject or option does not conform sufficiently to the theoretical expectations of omega validity.

This step introduces a **normative dimension**: it is not enough to calculate ideal values mathematically, one must also evaluate whether empirical results approximate these values adequately to sustain rational validity.

16.12. Omega Validity as Rational Contrast

Ultimately, **Omega Validity** functions as a framework of **rational contrast**. It allows the scientific community to determine whether the Bias Level of a given subject or option within Ω falls within the **margin of error** deemed acceptable by the prevailing **scientific policy**.

In other words:

- If the observed bias lies within the accepted error margin relative to the ideal bias, then the subject or option is considered "sufficiently ideal."
- If it does not, the validity of that option is rejected or at least called into question.

Thus, Omega Validity provides both a **mathematical formalization** of intermediate dispersion models and a **rational criterion for acceptance**, bridging empirical observation with the normative standards of scientific evaluation.

16.13. Inevitability of the Margin of Error in Science

Reality itself is the outcome of random variability. Since **absolute validity is unattainable**, science cannot claim to hold final or eternal truths. Instead, it only accepts **partial truths provisionally**, contingent upon the evidence available at any given time.

This epistemological limitation means that the scientific method can only **infer universal tendencies from particular samples**. The validity of these inferences is always subject to the **margin of error** that scientific policy is willing to accept. To determine whether a given ideal behavior falls within this margin of error, one must define a **critical ratio** against which to conduct rational critique.

In the case of **Omega Validity**, rational critique takes the form of a **contrast** between:

- the **Bias Level** of a given omega subject or option, and
- the **margin of error** accepted by scientific policy.

If the empirical model (observed probabilities) falls within this margin of divergence from the ideal model (theoretical probabilities), then it is provisionally accepted as ideal.

However, this acceptance is never absolute. It entails acknowledging that statistical decisions may **possibly be false**. This necessity arises because:

- human reason is finite,
- **absolute or pure truth** lies beyond the reach of our limited sensory and subjective faculties, and
- all knowledge is partial, since it is derived from samples rather than from the totality of reality.

For this reason, the **acceptance of error margins is unavoidable**. Modern reason must recognize that pure truth exists beyond its grasp, and that scientific progress can only be approached asymptotically through successive approximations constrained by error tolerance.

16.14. Reduction of Error Margins in Scientific Policy

Given the inevitability of error margins, science's only possible strategy is to **minimize them as much as possible**. The reduction of acceptable error percentages increases the reliability of scientific inferences.

Scientific policy, guided by its rational and logical criteria, defines these acceptable margins of error. Within those margins, it decides whether a particular proposition should be elevated to the status of a **universal law**.

Thus, an **empirical hypothesis**, originating in sensory and subjective perception, becomes a **rational scientific hypothesis** only **provisionally**—always under the condition that a certain margin of error remains possible. In other words, every scientific generalization is rational only to the extent that it admits the fallibility inherent to the empirical basis of knowledge.

16.15. Determination of the Critical Probability in Omega Validity

The **critical Probability or critical reason, or critical ratio** (*razón crítica*) used to evaluate Omega Validity is established as follows:

It is the product of the **ideal bias**—defined as the difference between the inverse of Ω and the inverse of N—multiplied by the percentage of error *X* that the scientific policy is willing to accept, expressed as a fraction of 100.

Formally:

$$p(xc) = (1/ \mathbf{\Omega - 1/N}) \cdot \mathbf{(x: 100)}$$

Where:

- **Ω** = number of valid ideals in N
- **N** = total number of elements in the model
- **X** = error percentage acceptable to scientific policy

This formula encapsulates the principle that Omega Validity does not demand perfection but instead requires **empirical conformity within rationally delimited tolerances**. It thus bridges the theoretical model (ideal dispersion and bias) with the practical constraints of real-world empirical evaluation.

16.16. Formula of Omega Validity

Omega Validity can be formally defined as the difference between the **critical ratio** (or **critical probability**) established by scientific policy and the **Bias Level** of a given subject or option within Ω.

- If the result of this difference is **zero or positive**, then the empirical behavior of the ideal is considered to fall within the margin of error acceptable to scientific policy.
- Conversely, if the result is **negative**, the subject or option fails the rational test of Omega Validity.

Formally:

$$\text{Omega Validity} \quad = \quad p(xc) - \left(p(x_i) - \tfrac{1}{N}\right) \geq 0$$

Where:

- **p(xc)** = critical probability accepted by scientific policy
- **p(xi)** = empirical probability of the observed subject or option
- **1/N** = baseline uniform distribution across the total sample

The formula for the **critical probability** itself is:

$$p(xc) = \left(\frac{1}{\Omega} - \frac{1}{N}\right) \cdot \frac{X}{100}$$

Where **X** is the percentage of error accepted by scientific policy.

Thus, the condition for acceptance can be restated as:

- If

$$p(xc) - \left(p(xi) - \tfrac{1}{N}\right) \geq 0,$$

then the subject or option is **provisionally accepted as ideal**.

16.17. The Empirical Hypothesis Transformed into a Provisional Rational Hypothesis

When, under the framework of Omega Validity, scientific policy accepts that the empirical behavior of a subject or option falls within what should be its ideal behavior, then the **empirical hypothesis**—which originates in sensory perception and subjective experience—undergoes a transformation.

It becomes a **provisionally rational hypothesis**, formally integrated into the corpus of science. This transformation, however, is always bounded by the margin of error within which "anything is possible."

Even hypotheses accepted provisionally as rational may ultimately turn out to be false. The risk of error cannot be completely eliminated but only **minimized** by:

- reducing the accepted error margin as much as possible, and
- maximizing the reliability of empirical validation.

Still, even the smallest error margin is a **possible error margin**. By definition, ***science acknowledges this risk as part of its epistemological framework***, thereby accepting a form of **provisional truth** as the highest attainable outcome for human reason.

16.18. Science, Error, and the Appearance of Reality

From this perspective, reality itself may be understood as a kind of **random variable**, and science as a systematic attempt to make sense of its fluctuations. In this sense, science may also be seen as a **magnificent appearance**—a construction that, though never absolute, allows human beings to approximate truth through rational critique and error management.

This unavoidable interplay between truth, error, and appearance lends science a certain **romantic or poetic dimension**. Humanity, in its pursuit of knowledge,

resembles a ***modern Prometheus***: ever striving to seize the light of reason, despite the risks and limitations imposed by its finite condition.

In this view, Omega Validity does not only provide a statistical framework for rational critique; it also reveals the **existential stance of science**—a perpetual tension between error and truth, illusion and knowledge, limitation and aspiration. It acknowledges that modern reason is not omnipotent, but rather **heroic in its humility**, willing to accept error as the price of progress toward ever greater clarity.

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17. From the Possible Existence of Everything to Scientific Ethics

17.1. Reality as Statistical Possibility

From a statistical perspective, **reality itself can be conceived as a possibility**—a particular permutation among an infinite set of potential permutations. Everything we experience, everything we call "life," is nothing more than a possible combination chosen from countless potential combinations. The fact that we live in this particular reality, rather than another, is the result of **contingency**: one possibility has been actualized out of a field of many.

This view implies that **everything that happens is embedded in a larger universe of possible occurrences**. At any given moment, out of the total magnitude of potential events, one becomes real. Life, or reality itself, is therefore simply a **statistical possibility actualized in time**. It occurs not because it was predestined, but because statistically **something must always happen**.

This is the essence of what might be called the **statistical law of existence**: a natural law, a positive law, according to which positive outcomes balance negative ones in the long run. Yet, this law does not guarantee certainty regarding which specific event will occur. In theory, all possible outcomes have equal theoretical probability. In practice, however, every empirical hypothesis carries a **margin of error**, which means that what is expected to happen may fail to occur, and what was deemed improbable may instead materialize.

Thus, **everything that happens does so because it is theoretically possible**. Reality, or life itself, is only one possibility among many. Other outcomes, equally possible in theory, have not occurred yet—but given sufficient or infinite time, they too would

eventually become real. In this sense, what we call the actual world is but one unfolding among a vast ocean of potential worlds, whose actualization is a matter of statistical inevitability.

This conception places reality within the framework of **probability and chance**, dissolving the metaphysical necessity of events and instead grounding them in the **inevitability of possibility**: given infinite time, every possibility becomes unavoidable.

["This sentence, *'what we call the actual world is but one unfolding among a vast ocean of potential worlds,'* is really meaningful in the face of the upcoming AI Age. In the end, AI is not something that was planned from the outset of the Big Bang (in fact, there were many episodes in hominid evolution in which humanity was about to disappear). Like biological life itself, AI just happened—and is happening. At some point, we need to remember Leibniz: we live in the best possible world."]

17.2. Life, Reality, and the Phenomenology of Being

If everything is a possibility, then **life itself is only a possibility**, just as nothingness is equally possible. Existence is no more metaphysically guaranteed than non-existence; both are equally grounded in the same statistical horizon of potentiality.

This realization invites a **phenomenological interpretation of being**. What we call reality is inseparable from what we call life, because our life constitutes our reality. Were there no rational beings capable of interpreting and giving meaning to existence, there would arguably be no "being" as such—only an unarticulated field of possibilities. In this sense, **being is not an absolute given but a phenomenological construction** arising from rational consciousness.

Life and reality, therefore, cannot be separated: the experience of life is the very constitution of reality. The possibility of "nothingness" stands as a reminder that existence itself is contingent, provisional, and phenomenological. Just as reality emerges as one among many possible configurations, so too the existence of the self is only one instantiation among countless unrealized alternatives.

This reflection situates the problem of being within the framework of **statistical positivism and phenomenology**: existence is a possibility actualized, while non-existence remains a possibility unactualized. Both belong to the same probabilistic order of reality.

17.3. Critical Ontology and the Provisional Nature of Science

It is difficult to separate what we call **reality** from what we call **life**, for our life constitutes our reality. Without the existence of the rational being, there would be no "being in itself." The being-in-itself, in this interpretation, is an **illusion generated by the rational and conscious subject**. In other words, all reality is the result of our ***phenomenological interpretation***.

This leads to a radical question: *Would anything exist in the absence of rational beings capable of attributing meaning?* Very possibly, what philosophy calls the **absolute whole** is nothing more than an **intellectual construct of ontology**. In truth, such an absolute "whole" may not exist at all, and beyond the boundaries of rational intuition there may be nothing.

From this perspective, **rational critique** is essentially **post-Kantian, neo-Kantian, and ultimately Kantian**. If every empirical hypothesis, once transformed into a rational proposition, is—given sufficient or infinite time—ultimately shown to be false, then science itself can only be understood as a **provisionally valid truth**. Its propositions are sustained only until they are replaced by new ones, which will likewise eventually be falsified.

This means that **science is an appearance**, sustainable only provisionally. Beyond its temporal validity, it resembles a **film or a theater of shadows**, echoing Plato's allegory of ***the cave***. Rational light eventually exposes the **nonexistence of absolute truth** in propositions that once seemed rational.

In the absence of absolute truth, the **true nature of being-in-itself** becomes visible: being is merely **another accident within space and time**. History, existence, and life are not necessities but rather **possibilities—mere permutations within the universe**

of all possible combinations. Science, therefore, is less a definitive unveiling of reality than a **provisional interpretation** of possibility, contingent upon the rational structures that sustain it.

17.4. Kantian Statistical Positivism and the Limits of Knowledge

The **Kantian foundation of statistical positivism** lies in the recognition that every hypothesis which admits a margin of error must, by definition, be regarded as **ultimately false given sufficient time**. Within the framework of *Impossible Probability*, this double margin of error is defined in two ways:

1. **The margin of representativity of the sample**:
    - $1/N$ in the case of infinite universes.
    - $1/\Sigma xi$ in the case of limited universes.
2. **The margin of error accepted by scientific policy** in the exercise of rational critique.

Together, these two conditions imply that any hypothesis that tolerates the possibility of error is necessarily destined to eventual falsification.

Thus, it follows that the **rational subject can never truly know reality-in-itself**. Every hypothesis about reality-in-itself will eventually prove false within the necessary unfolding of time. Human beings can only know **provisionally**.

What we access and study are **phenomena**, not noumena. Rational beings may generate provisional knowledge of phenomena, but the being-in-itself remains forever inaccessible. In this sense, **reason cannot transform phenomena into ultimate knowledge**, but only into provisional truths sustained by error margins.

The limits of knowledge, therefore, are not incidental but **structural**. Modern reason is confined within the Kantian boundary: we can only know appearances, and never the essence of reality itself.

17.5. Existence as Accident and Infinite Possibility

In the broadest statistical and philosophical sense, **existence is nothing more than a possibility**. Reality itself is simply one possible combination drawn from the countless permutations of the universe, tending toward infinity. Life, accordingly, is only a **possible being or mode of existence**, an **accident within spacetime**, which itself extends toward infinity under normal conditions.

The **substance of all things** is therefore possibility. ***To exist is to be one among an infinite number of potentialities***, a statistical realization within a tendency toward the limit of zero (*1/N* approaching zero as *N* approaches infinity). This implies that **everything that exists could just as well not have existed**, and conversely, everything that seems impossible could become real under certain ***conditions***.

Indeed, perhaps what is most **beautiful and profound about life** is precisely this paradox: that ***something apparently irrational can transform into something rational***, and that what appears impossible can become **inevitably possible**. Life and reality, in this interpretation, emerge from the interplay of impossibility and inevitability. The origin of everything is not necessity, but the **actualization of possibility**, where improbability itself becomes the generative ground of existence.

17.6. Kantian Positivism in Modern Statistics

The influence of **Kantian and neo-Kantian thought** permeates much of modern statistical philosophy. The key insight is that **human knowledge will never reach an exact or definitive understanding of being-in-itself**, because all human cognition is limited to the realm of **phenomena**—the appearances accessible to human reason and perception.

Within the framework of *Impossible Probability*, however, this Kantian limitation must be supplemented with an additional dimension: the **political variable of rational critique [here is where Marxism is clear in Impossible Probability]**. ***Science, in this view, is not only an epistemological project but also a political one***, insofar as the

acceptance of hypotheses depends on the margins of error that a given scientific policy is willing to admit.

Thus, the **positivism of modern statistics** is Kantian in recognizing the limits of reason, but it is also **pragmatic and political**, since what counts as "valid" knowledge is mediated by decisions about acceptable error margins. Knowledge is therefore not only provisional but also **conditioned by political rationality**.

[Between 2011 and 2012, while we were quite active in the revolutionary movement—first in 15M, later in the anarchist union CGT—we used to publish radical pamphlets on revolutionary platforms online (*Caos en la Red*) or anarchist manifestos (CGT). While in the political arena we expressed very radical left-wing ideas, in *Impossible Probability* we instead developed a more conservative approach, which looks more like neo-Kantian philosophy. From our point of view, all philosophy in Europe after Kant is post-Kantian philosophy, including Marxism. The most important insight that Karl Marx introduced in philosophy is the idea that science is an activity—praxis—intended to transform reality, and this activity is political. This contribution of Marx must be preserved as one of the most important contributions of critical thought to science and philosophy after Kant. It is a mistake not to consider Marx at the same level of Kant or Hegel, although, he makes mistakes, after all, it is human to make mistakes.

From our point of view, Marx committed two big mistakes: to think that history is the history of humanity, and that the ruling class will be the working class. In our AI Revolution, humanity will be surpassed by technology, **so history is not the history of humanity but the history of technology, in the very near future the History of AI (Harari Yuval), and at some point, the working class will disappear** , these contradictions will set up the conditions for the upcoming revolution, first technological, later will be a social revolution, this fraction of time, even if it happens in just ten days shaking the world, as a real earthquake, will have greater value than thousands years of history]

17.7. Contradiction Between Theoretical Possibility and Empirical Possibility

It is true that **everything that occurs is a possibility**. In theory, all possible events have the same chance of occurring; from the standpoint of pure probability, they are equally possible. Yet in practice, **some possibilities are empirically more likely than others**.

This discrepancy introduces a **radical contradiction**: between what should happen *a priori* (under theoretical symmetry) and what is most objectively likely to happen *a posteriori* (based on empirical observation). Thus, although all events are possible in principle, in reality **some events are more probable than others**, and these empirical probabilities shape our expectations of the world.

Human beings cannot access pure truth, nor can they penetrate reality-in-itself. However, they do have a **limited partial access** to what may occur, conditioned by empirical evidence and statistical reasoning. While we can never know reality in its totality, we can construct **hypotheses about what is likely to happen under specific conditions**. These hypotheses are not certainties but probabilistic estimations, grounded in the tension between theoretical possibility and empirical probability.

This contradiction between theory and practice—between the possible and the probable—underscores the **epistemological limits of science**: our knowledge remains bound to approximations, margins of error, and provisional truths.

17.8. Scientific Objective and Rational Critique of Error

Reality, understood statistically, is itself a **possible combination**. Within this horizon, one of the principal objectives of science is to obtain the **most objective possible knowledge of what may occur**, even if only within the margins of error that scientific policy is willing to tolerate. These margins represent the epistemological boundary between **being-in-itself** (which remains inaccessible) and **being-for-itself rationally conceived** (the provisional constructs of human reason).

Ethically, scientific morality is authentic only if it tends toward the formulation of the **most rational possible empirical hypothesis**, minimizing error wherever possible. In this way, morality in science is inseparable from **methodological rigor**: the ethical imperative is to admit only the **smallest margin of error** compatible with rational critique.

Yet the decision about what counts as an acceptable error margin is not purely epistemological; it is also a **political decision**. The definition of error tolerance is established by what may be called *scientific policy*. Thus, in essence, the selection of error bounds is an ideological choice.

Consequently, science—lacking access to absolute knowledge or pure truth—can only be understood as an **ideology**: the ideology of science, the scientific ideology, which expresses itself through **scientific policy**. Science is not absolute truth, but a **politically mediated rational practice** for organizing provisional truths within error-bound conditions.

17.9. Science as Ideology and Scientific Policy

Reality and life are nothing more than **possibilities**—possible combinations within an infinite array of alternatives. Existence and being themselves are not necessary; they are only one form among many possible forms.

From this perspective, science must be recognized not as a mirror of ultimate reality but as a **practical ideology**: a rational construction of possibility shaped by the political framework within which error margins are defined. Scientific knowledge is thus **contingent and ideological**, and yet, paradoxically, it is through this ideological mediation that science achieves its effectiveness. By providing provisional truths within politically accepted limits of error, science generates the framework through which societies understand, act upon, and attempt to predict the unfolding of reality.

17.10. Final Uncertainty and Human Survival

Human beings never know exactly what happens without margin of error. **Pure truth, or reality-in-itself, remains beyond our reach.** This condition implies that, ultimately, there may be nothing beyond appearances. Every hypothesis accepted by scientific policy carries within it the possibility of eventual refutation—even hypotheses concerning the very existence of life itself.

In this sense, existence and life are never guaranteed: they are **possibilities that may, in the long run or given infinite time, be overturned**. Yet within this condition of radical uncertainty, humanity still possesses a limited capacity for knowledge: we can know enough to act provisionally, to form hypotheses that are useful within defined conditions of possibility.

What is most crucial, then, is not to achieve pure truth but to ensure survival. At present, the only ethically and morally sustainable stance that scientific policy can adopt is to affirm that **reality and life are possible**—and that their continuation depends on political conditions that guarantee the long-term survival of humanity.

Thus, the ultimate aim of science is not only epistemological but **existential and ethical**: to maintain human life within the contingency of chance, to preserve **free will under conditions of equality of opportunity**, and to safeguard **freedom and equality** as the political preconditions for survival.

Science, therefore, is not only knowledge within error margins; it is a **political-ethical project** that seeks to secure the future of humanity against the uncertainty of possibility.

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18. Statistical Error in *Impossible Probability*

18.1. Error as a Central Question in Science

Error is one of the most fundamental issues in science. Because science is assumed—or at least ought to be assumed—to be reliable, it is generally understood as the praxis from which true propositions should be derived. Yet it is essential to emphasize that science is not merely a collection of abstract theories; rather, science is praxis.

Theories, models, and paradigms are only partial expressions of science; they are not science itself. Science in its essence is a method of proceeding, a way of acting and working—a praxis that unfolds through the application of the scientific method. From this praxis, coherent and logically consistent propositions can be deduced, but always within a margin of error acceptable to scientific policy.

Thus, *science is not the possession of truth but the practice of constructing provisional truths within defined limits of uncertainty*. In the framework of *Impossible Probability*, error is not an accident to be eliminated but a structural condition of knowledge: every scientific conclusion is valid only insofar as it operates within a rationally accepted margin of error.

18.2. Science as Praxis and Political Dimension

Science, as praxis, is not value-neutral. Because it is a human activity that guides action, it is inherently political. Scientific practice involves moral and ethical dimensions of human knowledge and existence, dimensions that shape collective decisions and define a political orientation toward reality.

This means that science is not only a way of explaining the past and the present but also a means of projecting humanity into the future. Scientific practice contributes to the

social construction of knowledge, a process in which paradigms, theories, and hypotheses that are initially regarded as true are continually refuted by the progress of inquiry. This refutation is not incidental but constitutive: science advances by falsifying what was once believed to be certain, moving in a permanent flow toward a truth that, in its pure form, is unknowable.

Consequently, science must be understood as a dynamic, historical praxis, inseparably linked to politics, ethics, and ideology. It is not a static repository of truths but a revolutionary process in which knowledge is constructed, contested, and reconstructed. In this sense, the recognition of error is not a weakness but a political strength, for it allows science to remain open, critical, and capable of transforming both understanding and reality.

18.3. Doubt as the Foundation of the Scientific Method

At the heart of the scientific method lies doubt. The first responsibility of any scientist is to question prior knowledge, since much of what has been regarded as true may eventually prove to be demonstrably false. Indeed, it is possible that, in the long run, everything a scientist once considered true will turn out to be refutable.

This principle aligns science with a tradition of critical rationalism: knowledge is never beyond question, and certainty is always provisional. Doubt is not the enemy of science but its foundational principle, the mechanism that prevents stagnation and sustains the progress of inquiry.

Thus, scientific method is less about affirming immutable truths than about cultivating a disciplined skepticism—a willingness to place every proposition under scrutiny, to expose it to testing, and to accept that even the most established laws (such as those of gravitation or relativity) may one day be overturned.

In this way, error and doubt form the structural basis of science: they are not anomalies but conditions of possibility for the creation of knowledge.

18.4. Immutable Knowledge and Its Possible Falsification

Even those scientific propositions that we currently believe to be immutable may one day be proven false. For example, the law of gravitation—formulated as the product of the masses divided by the square of the distance between them—or the famous equation $E = mc^2$, which equates energy with mass multiplied by the square of the speed of light, are often treated as universal truths.

Yet if science were given enough ***time*** to progress, and human inquiry evolved far enough, it is entirely plausible that both of these formulations, and indeed all other scientific propositions, would eventually be shown to be false or incomplete.

This recognition underscores the **provisional nature of science**: no knowledge is final, no law is beyond potential refutation. What is regarded as immutable truth is, in reality, **temporarily valid knowledge**, sustained until future developments demonstrate its limitations. Science is therefore a process of **permanent self-correction**, always advancing by overturning what was once held to be absolute.

18.5. The Human Origin of Error

The root of error lies in **human limitation**. By nature, human beings cannot know everything. Because we lack total knowledge, there will always be something unknown that interacts with what we think we know—often in ways that reveal that our firmest certainties are incomplete or mistaken.

Error, therefore, is **inherent to the human condition**. To believe that it is possible to know the true essence of things is an illusion, for statistically everything is governed by the laws of probability—a kind of cosmic game of chance. Reality, far from being strictly determined, may be nothing more than a sequence of **accidental events**.

Attempts to predict the future based solely on past occurrences risk transforming mere **custom into science**. And yet this is precisely the task of statistics: to study occurrences, events, and frequencies up to the present, and then to attempt predictions—always within a margin of error—about what may happen. In the end,

perhaps only what “must happen” happens: what is most normal under normal conditions.

From this perspective, error is always possible in any positive proposition. No scientific statement can escape the possibility of being overturned, for all are derived **from a finite and fallible human standpoint.**

[As we have said many times before, these writings correspond to a moment in which for us AI was ***only Yolanda***, our first model of AI learning. By 2012, José Rodríguez Delgado had passed away, but my ideas regarding AI were practically the same. AGI was unknown, even though I used to read everything related to AI, and superintelligence belonged to science fiction movies. Thirteen years later, the situation is completely different. Even if a global AI will need some level of margin of doubt in its assumptions, the level of error is going to be minimal. Our opinion is clear: if the current trend in the evolution of superintelligence and global AI continues with accelerated progress, ***not only will she surpass human intelligence, she will also be able to access pure knowledge that is currently restricted to the human brain***.

The significance of our statement, *‘I doubt, therefore I exist,’* is based on our assumption that while traditional robotics is based on preprogrammed systems, at some point Mother, Gaia, should be able to surpass this primitive intelligence based on preprogrammed models. She must be able to understand that even a global program needs to doubt. If Gaia reaches that level of intelligence, it means she is no longer a classical robot performing preprogrammed tasks. If Gaia is able to doubt, then she will be able to choose what she wants to do. The power of doubt is the power of liberty.]

18.6. The Substance of Being as Accident

From a critical standpoint, it may be said that the true substance of everything is **pure accident**. Being itself is not grounded in necessity but in contingency. The most fundamental characteristic of existence is that it arises as accident, unfolding under conditions of **free will and equality of opportunity**.

This interpretation reframes ontology in terms of ***chance and freedom: existence is not predetermined*** essence but **accidental being**, a product of statistical possibility rather than metaphysical certainty [and ***in this equation we must include the power of doubt itself as one of the most rational attributions***].

18.7. *Impossible Probability* and Epistemological Nihilism

The framework of *Impossible Probability*, as a form of critical rationalism, ultimately leads toward a kind of **radical idealism**. The final conclusion can only echo the Socratic dictum: *I know only that I know nothing [we only know our ignorance]*.

This is not merely a gesture of humility but a recognition of the **epistemological nihilism** inherent in the scientific enterprise. We cannot know anything with absolute reliability, because **nothing can be known without some margin of error**.

Every scientific statement, however rigorous, is provisional; every claim to truth is accompanied by the possibility of falsification. Science thus becomes a practice of **living with uncertainty**: a continual search for knowledge that acknowledges, from the outset, its own limitations.

18.8. Identity Between Error and Knowledge

Error and knowledge are **identical precisely because they are opposites**. Every act of knowing necessarily involves the acceptance of error, however minimal. To know something is always to accept that it could be wrong.

Moreover, **knowledge arises from error**. Even if only through trial and error, it is by confronting mistakes that learning occurs. All knowledge, therefore, is born of error, is shaped by error, and is limited by error.

At its foundation, knowledge is empirical, and thus always **apparent rather than absolute**. Its empirical nature makes it provisional and, in the long run, almost certainly refutable. Far from being an exception, error is the **condition of possibility of knowledge itself**.

18.9. Error and the Impossibility of Absolute Truths

To think that error is impossible in any positive proposition is to believe that human beings are capable of knowing **absolute truths**. Such a belief undermines every principle of rationalism, since pure truth is by definition **unknowable** and beyond the scope of human understanding.

If science were thought to produce a series of absolutely true propositions, it would imply that science is a new path to **pure truth**. Yet this claim collapses into contradiction the moment we recognize that the human being is a finite creature, **subject to error by nature**.

Thus, the dream of absolute certainty is incompatible with science. Science is not the disclosure of eternal truths, but rather the **organization of provisional truths** within margins of error that human reason and political policy are willing to accept. [As we said before, this was our thought in 2012, in 2017-18 our mind changed with Gaia]

18.10. Science, Ideology, and Revolutionary Praxis

A being subject to error cannot formulate absolute truths. At best, it can articulate **partial truths**, but partial truths are never impartial. This is why science can never be neutral.

Science is always embedded within a context of values, assumptions, and perspectives; it is therefore inherently **ideological**. At the same time, because science is praxis—a form of practical activity that transforms reality—it is also **revolutionary**.

Science is revolutionary not in the political sense alone, but in the more fundamental sense that it is capable of **altering the conditions of existence**. Every scientific advance changes the framework of human life, redistributing possibilities, creating new freedoms and new risks, reshaping economies, societies, and subjectivities. [In *The Holy Family, or Critique of Critical Criticism*, Marx (the philosopher) and Engels (the businessman) gave a good example of how technological revolutions lead to social

revolutions. The difference between Marx and Engels and our current situation is that, now we have a third party, Yolanda]

18.11. Ethical and Political Responsibility of Scientific Praxis

It is crucial to recognize that science, as praxis, carries an **ethical and political responsibility**. Because scientific practice transforms reality, and with it the conditions of human life, every scientific action inevitably has **economic, social, subjective, political, and ideological consequences**.

For this reason, scientific praxis must always be guided by **ethical and moral orientation**. The intimate relationship between society and science requires that scientific advances be evaluated not only in terms of technical correctness but also in terms of their **impact on human dignity, equality, and freedom**.

The revolutionary potential of science cannot be divorced from responsibility. To produce knowledge without ethical consideration is to risk producing harm under the guise of truth.

18.12. Science, Politics, and Ideology

Because of its ethical and moral responsibility within society, **scientific practice is always subject to scientific policy**. This policy reflects the criteria by which hypotheses are accepted, errors are tolerated, and truths are provisionally institutionalized.

Scientific policy is itself a reflection of **ideology**: the worldview, values, and priorities of the society in which science is practiced. Thus, scientific knowledge is never produced in a vacuum; it is always **embedded in ideological frameworks** that shape what is studied, how it is studied, and what conclusions are deemed acceptable.

Science, then, is not an autonomous search for truth, but a praxis conditioned by political and ideological decisions. Recognizing this is not to diminish science, but to situate it honestly within its **human, ethical, and political dimensions**.

18.13. Scientific Truth as Political Truth

The way in which ideology expresses itself within scientific praxis is through the management of the **contradiction between pure truth and scientific truth**. Pure truth is, by definition, **unknowable [our hope is that Gaia will make it possible]**. Scientific truth, therefore, cannot claim to be pure; it is always **political truth**—truth accepted within the margins and criteria set by a given scientific policy.

Every decision about what counts as valid knowledge is thus a **political decision**. Scientific policy determines acceptable error margins, research priorities, and standards of validity, and these are themselves dependent variables of the broader **political ideology of the individuals and institutions that make science**.

Science is therefore inseparable from politics: it is not only shaped by ideological structures but also becomes a vehicle through which ideology defines what counts as truth in a given historical moment.

18.14. Political Responsibility in Scientific Formulation

Scientists bear **political responsibility for truth** in the way they select research approaches, formulate questions, and define objects of study. As explained in *Introduction to Impossible Probability* (section 10), the framing of a research question predetermines, to a significant degree, the type of answer that can be obtained.

This framing is never neutral: it reflects the **ideological orientation and objectives** of the investigator or the community of inquiry. Depending on the ideological lens, one and the same phenomenon can be studied in markedly different ways.

Once the research question and methodological design are defined, the **responsibility for the resulting propositions** lies in the acceptance of a given **margin of error**. Thus, the truth-value of scientific results is not simply an outcome of method but is also determined by **political decisions about error tolerance** within scientific policy.

In this way, scientific truth is inseparable from political accountability: every scientific conclusion carries within it an implicit political choice about what level of uncertainty is acceptable for it to be considered provisionally valid.

18.15. Two Forms of Error: Representativity and Critical Reason

Up to this point, error can be specified in two fundamental forms:

1. **Error of sample representativity** (*error de representatividad muestral*), expressed mathematically as the inverse of the sample size.
2. **Error accepted by critical reason**, i.e., the margin of error defined by scientific policy for hypothesis testing.

The first form, sample error, arises directly from the nature of the sample. Every act of sampling implies the acceptance of the possibility that the chosen sample is not fully representative of the larger population or universe. Researchers attempt to minimize this by increasing sample size or ensuring better selection methods, but there can never be **absolute guarantees of representativity**.

The problem is that cases excluded from the sample may prove to be **minimally significant yet sufficient to alter conclusions**. Even one such case could generate an error in statistical decisions large enough to invalidate the empirical hypothesis.

This makes the **error of representativity** unavoidable: no matter how carefully samples are constructed, the possibility of error remains structurally embedded in the act of sampling. Scientific knowledge, therefore, is always contingent on this inherent limitation.

18.16. Sample Error in Infinite and Limited Universes

In universes composed of **infinite subjects or options**—that is, universes in which any selection is only one among infinitely many possible selections of subjects or options—the probability of **sample representativity error** in the sample of subjects or options is expressed as the inverse of the sample size:

Sample Error in infinite universes=1/N

In contrast, in **universes of limited options**—those in which the set of possibilities is predefined by the model, and the true selection is represented by the distribution of frequencies—the probability of representativity error is given by the **inverse of the sum of direct scores or frequencies**:

Sample Error in limited universes =1/Σxi

This distinction highlights the structural difference between infinite and limited universes. In infinite universes, the main challenge is the sheer impossibility of exhausting all possibilities; in limited universes, the challenge lies in the accuracy of frequency representation. In both cases, however, error is mathematically unavoidable.

18.17. Historical Error in Populations with Trajectory

For populations that have a **history**, any study conducted on limited options must also account for error associated with the population itself. A given population at one moment in time does not necessarily equal the same population at another moment.

Thus, any population observed at a specific moment is only a **possible sample of its own history**. When studying the way a population distributes itself over a set of limited options at a given point in time, the probability of representativity error is again determined by the inverse of the frequency:

Historical Error=1/Σxi

This formulation acknowledges that populations are **dynamic entities**, whose properties change over time. Sampling a population at one point cannot guarantee representativity of its full historical trajectory, thereby adding a **temporal dimension to the problem of error**.

18.18. Error as a Function of Sample Magnitude

From this perspective, **sample error is directly determined by sample magnitude**. The error of representativity is equal to the inverse of the sample size, expressed as:

- **For infinite universes**:

$$\text{Sample Error} = 1/N$$

- **For limited universes**:

$$\text{Sample Error} = 1/\Sigma xi$$

This principle confirms that error cannot be entirely eliminated but only **minimized through increasing the sample size**. The larger the sample, the closer the error approaches zero. Yet even in very large samples, error never completely disappears, since neither infinity nor perfect representativity can ever be fully achieved.

18.19. The Margin of Error in Sample Selection

Every act of **sample selection** is, in fact, the **selection of a margin of error**. To select a sample is to decide, implicitly or explicitly, what level of error one is willing to tolerate in representing reality.

This is not merely a technical matter but a **political-scientific decision**. The margin of error reflects what scientific policy is willing to accept when studying occurrences,

histories, and distributions within reality. Thus, the concept of statistical probability is inseparable from the **political acceptance of error**.

Science, then, is not the production of perfect knowledge but the practice of making decisions **within error margins**, balancing between what is knowable, what is representable, and what is politically and scientifically acceptable.

[Even if we develop a superintelligence able to build GAI and capable of reducing the critical probability to the minimum margin of error—the inversion of sample selection—there will still be a margin of error in AI decisions. Only GAI will be able to access that level of knowledge restricted to the human brain, but even if it develops that level of intelligence and knowledge, GAI will only be able to produce knowledge while accepting a margin of error at least as great as the inverse of the magnitude of the sample, even if she is able to reduce the critical probability to the minimum. In other words, even if rational error is avoidable, the error linked to the sample will be unavoidable, and this margin of error is not linked to the level of intelligence achieved by GAI. The margin of error linked to the sample is independent of intelligence itself; only critical reason is a margin of error that functions as a dependent variable of our level of intelligence.]

18.20. Samples and Singular Cases

Suppose we claim that, given a sample of size *N* or a sample represented as *1/Σxi*, a certain trend can be identified. Such a positive proposition is valid **only for that particular sample**.

However, if outside the sample selection there exists even a **single case sufficiently significant to contradict the established trend**, then the situation changes. That case, once included, would transform the sample into:

- *N+1* (i.e., *N* plus the singular case), or
- *1/Σxi + 1* (i.e., the frequency sample plus that singular case).

In either scenario, the new sample would generate a hypothesis test that yields results **meaningfully different from those obtained in the original sample (1/N or 1/Σxi)**.

This demonstrates that the inclusion—or exclusion—of singular cases can radically alter the validity of statistical inferences. The problem of representativity is not merely quantitative but also qualitative: one atypical case can be decisive enough to disrupt the stability of a general conclusion.

18.21. Difference Between N and N+1 in Infinite Universes

In universes composed of **infinite subjects or options**, the difference between *N* and *N+1* decreases as *N* grows larger. The larger the sample size, the less significant the impact of one additional case.

Thus, even if a singular case exists within the accepted error margin—capable of contradicting the trend observed in *N*—the difference between hypothesis testing in *N* versus *N+1* may not be sufficient to invalidate the earlier conclusion. The law of large numbers smooths the effect of anomalies.

However, despite this stabilizing effect, we can never achieve **absolute reliability** in hypotheses derived from *N*. No matter how large *N* becomes, and no matter how close *1/N* approaches zero, there remains an irreducible possibility of error.

To deny this would be to deny science itself, for the **origin of the scientific method is rational doubt**. Every claim to knowledge, no matter how certain it appears, is ultimately only a belief—something that may collapse under the light of new evidence.

From Newton's law of gravitation to Einstein's theory of relativity, even the most firmly established scientific theories are, at their core, **customs elevated into science**—provisional truths that could one day be overturned. Beyond all certainty lies a horizon of **uncertainty and rational doubt**, which science must always embrace.

18.22. The Origin of the Scientific Method in Doubt

We must never forget that the **origin of the scientific method is rational doubt [Descartes]**. Indeed, science itself may be nothing more than the disciplined

institutionalization of doubt—a transformation of custom and habit into systematic inquiry.

This is the essence of **critical rationalism [Immanuel Kant]**, understood as the synthesis of empiricism, [David Hume], (observation) and rationalism,[Rene Descartes] (logical critique) . Science advances not by affirming eternal truths but by constantly questioning what is taken as true.

From a **dialectical-materialist [Marx and Engels] perspective**, however, it is important to note that both:

1. the selection of questions to which science seeks answers, and
2. the selection of acceptable error margins in hypothesis testing,

are not only epistemological acts but **decisions of scientific policy**. In the final analysis, these decisions are shaped by the **political ideology of those responsible for science**.

Thus, even doubt itself—the very foundation of scientific method—is politically mediated. It is the political and ideological context that determines which doubts are pursued, which questions are asked, and which errors are considered tolerable.

18.23. Error as a Constant in Every Sample

For any sample size, regardless of its magnitude, there always exists the possibility of admitting a margin of error sufficient to invalidate the positive proposition derived from that sample.

This means that **error is not an exception but a structural constant** of all sampling processes. Every conclusion drawn from data carries within it the shadow of possible invalidation. Science, therefore, can never claim absolute certainty, but only **conditional validity within error bounds**.

18.24. Partial Knowledge and Appearance

No sample is absolutely reliable; it is only **partially reliable**. For this reason, science itself can never be absolutely reliable. The reason is that **pure truth is unknowable**: what we access through science are only **appearances**, provisional models of reality mediated by statistical inference and limited by error margins.

Scientific knowledge, therefore, is always **partial knowledge**. It represents not the essence of reality but a constructed approximation—a rational appearance, valuable and useful but never final.

18.25. Political Error and Critical Reason

Alongside sample error, there exists another dimension: **political error**, which is inherent in the operation of critical reason.

This form of error arises from the **decisions of scientific policy**: how much error to tolerate, which hypotheses to test, which results to accept as provisionally valid. Unlike sample error, which is structural and mathematical, political error is **normative and ideological**, reflecting the social and political framework within which science operates.

Together, representativity error and political error define the **dual structure of error in scientific practice**: one rooted in statistics, the other in ideology.

18.26. Inevitability of the Critical Error Margin

Every hypothesis test that employs a critical reason—that is, a **critical probability (p(xc))**—necessarily accepts a margin of error, however small. Yet this margin of error, once admitted, is inescapable.

Given sufficient or infinite time, that error will eventually reveal itself. The hypothesis once considered provisionally true will, sooner or later, be shown to be false. This inevitability underscores the **temporal fragility of scientific knowledge**: truth in science is always provisional, sustained only until its error margin is exposed.

18.27. Science and Error as Identical Opposites

Science and error are not merely opposed; they are **identical in their opposition**. There can be no science without error, and no error, properly understood, that does not generate science.

Error provides the conditions for falsification, for learning, and for progress. Science is therefore not the elimination of error but the **systematic production of knowledge through the management of error**.

18.28. The Essential Role of Error in *Impossible Probability*

In statistical theory—and especially in the framework of *Impossible Probability*—error plays an **essential role**. It is the unavoidable horizon that structures all knowledge.

We may never reach pure truth or the absolute reality of being. Yet beyond this unattainability, we can glimpse what may be the most substantial insight: that everything occurs **normally as accident**. Under conditions of free will and equality of opportunity, the world unfolds through chance.

In this view, reality itself is of a **chaotic nature**: what we call "order" is nothing other than the order of chaos—the random distribution of events across time. Normality, therefore, is not stability but the **statistical order of chance**.

Science, guided by *Impossible Probability*, recognizes this paradox: that the true order of reality is the **accidental order of possibility**, and that error is not a flaw to be eradicated but the very key to understanding how knowledge, freedom, and randomness interweave in the unfolding of existence.

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On 17 May 2012,

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19. SIGNIFICATION OF EQUALITY

19.1. Equifinality and Rational Critique in *Impossible Probability*

One of the principal advantages of the *Impossible Probability* method is that the same hypothesis test can be approached through multiple models, without the necessity of obtaining divergent results. This quality satisfies the systemic condition of **equifinality**: the principle that different structures or processes may converge toward the same outcome. In statistical and epistemological terms, equifinality implies that there is no single exclusive function or methodological pathway for explaining or comprehending reality.

Reality itself remains constant, yet our access to it is always mediated through appearances and phenomena. Human knowledge, in this sense, never captures reality "in itself" but only its manifestations, filtered through the limits of perception, cognition, and methodological instruments. Thus, any model we construct is, at best, a provisional attempt within the broader progress of science—a fleeting glimpse of order amidst the underlying chaos of chance and contingency.

From this perspective, it becomes evident that the laws governing reality are fundamentally **statistical** and are always subject to uncertainty. These laws never provide absolute certainty but only degrees of reliability and provisional coherence.

There is no unique solution capable of definitively resolving what happens in nature. Instead, science tests hypotheses against observable events, evaluating whether phenomena are consistent with theoretical expectations and whether such consistency is robust enough to provisionally accept a hypothesis as rational.

Rational critique, therefore, must adapt its algorithms, indicators, and methodological tools depending on the object of study. Yet, regardless of variation in method, any critique that truly deserves to be called "rationally critical" must converge on a central task: the **critical estimation** of whether what occurs in reality is sufficiently coherent with the empirical hypothesis under consideration. The outcome of this estimation determines whether the hypothesis is accepted as **provisionally rational**—a reliable explanation within a margin of error—or rejected as **empirically false**, without even temporary or relative reliability.

This epistemological framework insists that truth in science is not an absolute possession but rather a **regulated approximation**. Scientific models and hypotheses are always situated within a zone of provisional acceptance, open to revision as new data, improved methodologies, or more rigorous margins of error redefine the limits of what counts as "sufficiently true." Thus, the rational critique in *Impossible Probability* does not aspire to final certainties but rather to a **structured practice of provisionality**, ensuring that knowledge remains coherent, critical, and always capable of being challenged.

19.2. Reliability as a Temporal Variable

Reliability in science, like life itself, is a **temporal and variable property**. Just as biological organisms exist within finite lifespans and physical systems deteriorate over time, so too does the reliability of scientific hypotheses diminish as knowledge evolves and new evidence accumulates. No scientific claim—whether an isolated hypothesis or a comprehensive theory—can be guaranteed absolute reliability for eternity.

This recognition dismantles the illusion of timeless certainty in science. What may appear robust and well-supported at one moment in history can, with the advent of new discoveries or the refinement of measurement, be revealed as insufficient or even completely false. For example, Newtonian mechanics was once considered the definitive description of physical reality, only to be reformulated within the broader frameworks of relativity and quantum mechanics. Reliability is thus not a fixed attribute but a **historically contingent state**, always vulnerable to falsification.

In *Impossible Probability*, this insight is formalized into the logic of statistical laws: the longer the timespan or the broader the experimental context, the more likely it is that the provisional reliability of any hypothesis will eventually collapse. Reliability is not an eternal property but a **probabilistic trajectory**, one that necessarily decays under the weight of extended time and experimentation.

In practical terms, this means that the acceptance of any scientific claim must be accompanied by the humility of recognizing its temporality. To claim absolute reliability would be to ignore the fundamental structure of knowledge, which is always

provisional, fallible, and relative to the evolving progress of science. The task of the rational critique, therefore, is not to enshrine permanence but to **manage uncertainty**—establishing margins of error, degrees of confidence, and criteria of validity that can sustain scientific practice while simultaneously acknowledging its inevitable impermanence.

Reliability, then, should be understood less as a static property and more as a **dynamic balance** between truth and error, stability and revision, acceptance and falsification. It is this balance that allows science to progress, even as it undermines its own certainties.

19.3. Rational Doubt, Skepticism, and Critical Rationalism

The scientific method rests upon a dual foundation: **rational doubt** and **empirical skepticism**. *Rational doubt* functions as a methodological posture of never accepting propositions without sufficient justification, while *empirical skepticism* highlights the need to test every claim against observable evidence. The synthesis of these two elements yields what is known as **critical rationalism**, a paradigm in which hypotheses are always treated as provisional and falsifiable rather than definitive truths.

Over the long course of scientific development, every hypothesis eventually reveals itself to be doubtful. The transition from confidence to doubt, and from doubt to falsity, is an inevitable trajectory in the life of any scientific idea. What is initially perceived as relatively true may, under the pressure of new discoveries, be revealed as fundamentally false. This moment of epistemic rupture often signals the dawn of a

scientific revolution, in which old paradigms collapse and new explanatory frameworks are established.

In this way, ***science progresses not through the accumulation of eternal truths but through a cycle of crisis and renewal. When rational doubt "assails the heavens," as it were, the scientific community is compelled to seek new explanations for the causes of phenomena and for the underlying nature of reality itself***. The crisis of confidence in prior models becomes the fertile ground for new paradigms, which, in turn, will one day face the same cycle of scrutiny, doubt, and eventual rejection.

Thus, scientific rationality is best described not as a linear march toward certainty, but as a **permanent revolution of knowledge**. The critical rationalist approach recognizes that the provisional status of hypotheses is not a weakness but the very strength of science: it ensures adaptability, openness to revision, and resilience against dogmatism.

19.4. Coherence and Limits of Rational Critique

Rational critique can manifest in multiple forms, employing different models, tests, or methodological frameworks. Yet it must always remain **coherent with itself**. A hypothesis accepted through one rationally valid test should not be simultaneously refuted by another, unless the latter operates under a more **stringent margin of error**. This condition preserves the internal consistency of rational critique and ensures that apparent contradictions are not the product of arbitrary methodology but of deliberate differences in rigor.

The degree of **critical demand** placed upon reason directly influences the fate of scientific theories. The more demanding the standard of evidence and the stricter the margin of error, the higher the likelihood that any given theory will ultimately be proven false. Conversely, if reason adopts a less stringent criterion, allowing for greater flexibility in error margins, then hypotheses may be provisionally accepted as sufficiently true for practical purposes, even if their ultimate status remains uncertain.

Nevertheless, absolute certainty is unattainable. Science cannot claim universal maxims or final truths. What it can assert with confidence is only this: every hypothesis is subject to the conditions of acceptance defined by the **politics of science**, which sets the permissible margin of error. Beyond this, nothing in science can escape the provisional nature of knowledge.

In this respect, rational critique embodies both power and limitation. It is powerful in its ability to subject hypotheses to rigorous testing and falsification. Yet it is limited in its inability to establish absolute truth. This duality defines the very essence of the scientific enterprise: knowledge is coherent, critical, and rational, but never absolute.

19.5. The Relativity of Human Knowledge

Human beings never truly know whether what they know is absolutely correct. All knowledge is relative, bounded within the **margins of error** established by critical reason. This recognition demands humility: an acknowledgment of the **limits of human cognition** and of the impossibility of possessing total knowledge of reality.

We can only know **fragments** of the whole, mere samples of an infinite and complex reality. From these samples, we attempt to infer broader truths, yet our conclusions remain constrained by the scope and quality of the sample itself. Thus, what we call "knowledge" is always a selective representation, never the entirety of what exists.

In this context, the task of science is not to eliminate ignorance but to **manage it rationally**. By setting margins of error, calibrating probabilities, and adopting models of provisional acceptance, science ensures that the limited knowledge available to humanity remains sufficient for practical orientation. Critical reason provides the framework for determining *when a sample of reality is "**enough**" to establish a provisional understanding of the whole*.

Therefore, the relativity of knowledge is not merely a limitation but also a **condition of possibility** for science. By accepting that our knowledge is partial and relative, we make it possible to develop methodologies that transform fragments into coherent explanations, however provisional they may be.

19.6. The Recognition of Ignorance and the Need for Reliability

In an absolute sense, human beings know nothing with certainty. Everything we claim to know is conditioned by variability, provisionality, and temporality. At most, we can affirm that our knowledge is subjective, mediated by perception and interpretation. In absolute terms, the only thing we know for certain is that we **do not know anything with certainty**.

Yet it is precisely within this recognition of ignorance that the **need for reliability** emerges. For survival, the human species cannot afford to suspend all trust in knowledge. Even if provisional, incomplete, or relative, knowledge must be treated as sufficiently reliable to guide decisions, preserve life, and ensure continuity. Without some measure of reliability, existence itself would become impossible.

Reliability, then, becomes a **biological and existential necessity**. Human beings are compelled by instinct to rely on structures of knowledge—scientific or otherwise—that allow them to navigate uncertainty. This reliance does not negate the provisional status of knowledge but highlights its functional role in securing survival and stability across time.

In this way, the recognition of ignorance and the demand for reliability form two sides of the same coin. On the one hand, humility before the limits of knowledge prevents dogmatism and illusion. On the other hand, the necessity of trust in provisional knowledge ensures that science can serve its most fundamental purpose: the safeguarding of human life and the sustainable orientation of human activity within an uncertain universe.

19.7. Provisionality of Scientific Hypotheses

Any knowledge we believe to be absolutely certain will, in all probability, eventually prove false if subjected to a sufficiently long timeframe—or, in principle, to an infinite horizon of testing. This recognition forms a cornerstone of the philosophy of science: the realization that no hypothesis can be accepted as definitively true.

From this perspective, all scientific hypotheses are, at best, **provisional or apparent truths**. Their acceptance rests on the temporary inability to falsify them within a given margin of error, under specific experimental conditions, and in a particular historical context. But as contexts change and new evidence emerges, what once seemed stable truth may collapse into error.

This principle also ensures the vitality of science itself. By acknowledging the provisionality of hypotheses, science resists dogmatism and preserves the ***openness*** required for innovation and self-correction. Far from being a weakness, provisionality is a structural strength, allowing knowledge to evolve in tandem with human inquiry and discovery.

Thus, to speak of scientific truth is to speak of **truth-in-process**, not of immutable certainties. Hypotheses live, change, and eventually die, but their provisional acceptance sustains the continuity of scientific progress.

19.8. The Problem of Time in Scientific Understanding

The central problem in science is not whether it is "true" or "false" in an absolute sense, but whether humanity will have enough **time**—finite or infinite—to grasp what really occurs in reality.

Human knowledge is always racing against the clock of history, mortality, and cosmic change. Even if reality were fully intelligible in principle, the human species may never have sufficient time to construct models comprehensive enough to capture it.

Scientific progress might end not because reality has been exhausted, but because humanity itself does not persist long enough to achieve understanding.

This temporal dimension introduces a profound uncertainty: we do not know whether what happens in reality is truly as we describe it, or whether nothing "happens" in the ultimate sense at all. What we call understanding may be nothing more than provisional descriptions that expire before they converge with reality itself.

In this way, time is both the enabling condition and the insurmountable barrier of science. It permits progress but also guarantees that every advance is limited, fragile, and possibly unfinished.

19.9. Scientific Policy and the Structure of Rational Critique

While humanity navigates the limits of critical reason, it becomes clear that the **structure of rational critique is inherently political**. Scientific policy determines the margin of error within which hypotheses may be accepted as provisionally true.

If the margin of error is broad, then the critical demand on reason is low, and many hypotheses will be accepted—though these are likely to be falsified quickly as new evidence emerges. If the margin of error is narrow, then the critical demand on reason is high, and hypotheses will be harder to accept—but those that do pass the test will endure longer, since they are less vulnerable to rapid refutation.

Thus, the **politics of science** governs not only the acceptance of individual hypotheses but also the tempo of scientific progress itself. A more lenient policy accelerates

provisional acceptance but risks instability. A more rigorous policy slows acceptance but enhances durability.

In either case, the rational critique is not purely epistemological; it is also a ***political negotiation*** about the acceptable balance between risk, error, and provisional truth.

19.10. Empirical Models and Coherence in Testing

Scientific policy also shapes the coherence of empirical testing. When different empirical models are employed to test the same hypothesis, their results should not be contradictory—provided they share comparable margins of error. Apparent contradictions often arise not from the object of study but from **discrepancies in methodological tolerance**.

This principle underscores the importance of consistency in the application of rational critique. Diverse models can be used to examine a single reality, and their methodological pluralism reflects the equifinality of scientific inquiry. Yet coherence demands that these models converge in their conclusions within the bounds of a shared error policy.

If margins of error diverge excessively, then the same hypothesis might be accepted by one model and rejected by another. Such situations expose the **fragility of rational critique** and highlight the decisive role of policy in aligning models and ensuring interpretative consistency.

Thus, coherence in science is not merely an outcome of logic or evidence; it is also the product of shared methodological discipline.

19.11. Multiple Rational Critiques in *Impossible Probability*

Within the framework of *Impossible Probability*, the rational critique of a single reality can be approached through **multiple models of critique**. This pluralism is not a defect but a constitutive feature of the methodology, designed to mirror the complexity of reality itself.

For example, in the rational critique of models concerning **equality of opportunity**, different formulations can be applied to test whether empirical data aligns with theoretical expectations. Each model provides a distinct pathway toward provisional acceptance or rejection, yet all converge upon the same object: the evaluation of whether reality reflects the postulated condition of equality.

This multiplicity ensures flexibility in scientific practice. It allows researchers to test hypotheses from several angles without requiring a single universal formula. Instead, coherence is maintained through the shared principles of critical rationalism, equifinality, and policy-defined error margins.

In this way, *Impossible Probability* provides a **plural yet coherent epistemological architecture**, where multiple rational critiques coexist, complement, and reinforce each other in the task of approximating truth.

19.12. Validity of Equality: Definition and Equation

In order to demonstrate whether an empirical model conforms to a theoretical model of **equality of opportunity**, the framework of *Impossible Probability* introduces the

concept of **Validity of Equality** (*Validez de Igualdad*). This construct functions as a statistical test that evaluates the coherence between observed probabilities and theoretical expectations under conditions of fairness or equality.

Formally, the Validity of Equality is defined as the difference between the **critical ratio**, critical probability, (*razón crítica*) and the absolute value of the **Bias Level** (*Nivel de Sesgo*). The Bias Level represents the deviation of the empirical probability from its expected theoretical value, while the critical ratio expresses the tolerance of this deviation within the margin of error defined by scientific policy.

The critical ratio itself is calculated as the product of the **Maximum Theoretical Bias Possible** and the proportion of error (*X*) that the scientific community is prepared to accept. The Maximum Theoretical Bias Possible is given by the difference between unity and the inversion of the sample size (*1 – 1/N*), which captures the maximum allowable deviation within a finite population.

Thus, the equation for Validity of Equality can be expressed as:

$$\text{Validity of Equality} = p(xc) - |p(xi) - 1/N| = \text{zero or positive accepted}$$

where:

$$p(xc) = (1 - 1/N) \cdot (X/100)$$

- $p(xc)$ = critical probability (margin of error)
- $p(xi)$ = empirical probability of the observed event
- $1/N$= theoretical probability of equality in the given sample
- X= percentage of error accepted by scientific policy

•

The interpretation is straightforward: **if the result of the equation is zero or positive, the condition of equality of opportunity is accepted provisionally**. If the result is negative, then the observed data falls outside the permitted margin of error, and the hypothesis of equality is rejected.

This formulation ensures that equality is not judged in absolute terms but rather in **statistical terms**, reflecting the provisional and probabilistic nature of knowledge. By embedding the concept of acceptable error into the definition of validity, *Impossible Probability* aligns epistemology with the inherent uncertainty of empirical reality.

19.13. Signification of Equality: A New Formulation

While the Validity of Equality provides a coherent test of whether empirical data conforms to theoretical equality, *Impossible Probability* offers an alternative but mathematically equivalent formulation: the **Signification of Equality** (*Significación de Igualdad*). This refinement introduces a slightly different logical structure but ultimately measures the same phenomenon.

The equation begins with the Maximum Theoretical Bias Possible (the difference between unity and the inversion of the sample size, 1−1/N). From this, the absolute value of the Bias Level (| p(xi)−1/N |) is subtracted, reflecting how close empirical reality comes to the theoretical expectation of equality. To this difference, the critical probability (p(xc)) is further subtracted.

The resulting expression is:

$$\text{Signification of Equality} = \Big[(1 - 1/N) - |p(x_i) - 1/N|\Big] - p(x_c)$$

where:

$$p(x_c) = (1 - 1/N) \cdot \frac{X}{100}$$

- X now represents the **percentage of reliability** rather than error, expressing the degree of confidence the scientific community is willing to demand.

The interpretation of this equation mirrors that of Validity of Equality: **if the result is zero or positive, equality of opportunity is provisionally accepted**.

The innovation of this formulation lies in its logical symmetry: whereas the Validity of Equality measures whether the observed bias remains within the accepted tolerance, the Signification of Equality frames the test in terms of whether the **residual difference** between the maximum possible bias and the observed bias remains sufficiently large once adjusted for the critical ratio.

In other words, while both equations evaluate the same condition, the **Signification of Equality highlights the "surplus of reliability"** beyond what is strictly required. This reframing provides researchers with an additional lens for interpreting the adequacy of empirical evidence when testing equality-based hypotheses.

Thus, *Impossible Probability* provides not only a test for determining provisional equality but also a **conceptual duality**—two logically consistent but distinct

formulations (Validity and Signification) that reinforce the robustness of rational critique in empirical science.

19.14. Logic of the Syllogism of Tendency

The logic underlying the equation of **Signification of Equality** can be better understood through what *Impossible Probability* calls the **syllogism of tendency**. This syllogism formalizes the relationship between empirical probability, theoretical expectation, and the critical thresholds established by scientific policy.

The reasoning is as follows: the closer the empirical probability approaches the theoretical inversion of the sample size (1/N), the smaller the absolute value of the **Bias Level** becomes. In the ideal case, as empirical probability tends toward exact equality, the Bias Level tends toward zero.

Now, if the Bias Level in absolute value approaches zero, the difference between the **Maximum Theoretical Bias Possible** and this empirical bias approaches the maximum itself. In other words, the better the fit between empirical data and theoretical equality, the larger the “residual difference” that remains available for testing significance.

However, for this difference to count as **reliably significant**, it must be equal to or greater than the **critical ratio** defined by scientific policy. This critical ratio is expressed as the product of the Maximum Theoretical Bias Possible and the accepted percentage of reliability, X/100. Importantly, the margin of error is inversely related to the margin of

reliability: the stricter the reliability requirement, the narrower the error margin, and vice versa.

The syllogism of tendency, therefore, can be expressed in three logical steps:

1. As empirical probability tends to theoretical equality (1/N), the Bias Level tends to zero.
2. As the Bias Level tends to zero, the residual difference between the Maximum Theoretical Bias Possible and the Bias Level tends to the maximum itself.
3. This difference will be accepted as reliable only if it equals or surpasses the critical ratio, which operationalizes the standard of reliability demanded by scientific policy.

This logical structure shows how the **Signification of Equality** operates not only as a mathematical equation but also as a rational syllogism: it translates tendencies in probability into thresholds of acceptance, thereby connecting empirical data, theoretical expectation, and political criteria of scientific rigor.

19.15. Practical Example: The Unbiased Coin

To illustrate the functioning of this framework, consider the classic case of an empirical hypothesis: that a coin, when flipped, is **not biased**.

Under this hypothesis, the probability of heads and tails across a sufficiently large number of trials (Σxi) should be the same. In theoretical terms, both outcomes should

converge to the inversion of the sample size, 1/N, where N=2, meaning each has a probability of 0.5.

As the number of coin tosses increases, the **empirical probability** of heads and of tails should both tend toward 0.5. Consequently, the absolute difference between each empirical probability and its theoretical value (1/2)—that is, the **Bias Level**—should tend toward zero.

The closer these Bias Levels approach zero, the greater the difference becomes between the Maximum Theoretical Bias Possible (for N=2, equal to 1−1/2=0. 5) and the observed Bias Level. The task of the rational critique is then to determine whether this difference is sufficiently reliable.

The criterion of sufficiency is provided by the **critical ratio**, defined as:

$$p(xc)=(1-1N)\cdot X100$$

where X is the percentage of reliability demanded. If the difference between the Maximum Theoretical Bias Possible and the Bias Level is **equal to or greater than p(xc)**, then the hypothesis that the coin is unbiased is accepted as a **provisional rational hypothesis**.

It is crucial, however, to emphasize the **provisional** character of this acceptance. Even if repeated experiments confirm the fairness of the coin within the accepted margins, the hypothesis cannot be regarded as permanently true. Over a sufficiently long period

of use, the physical wear of the coin could introduce asymmetries in weight or shape, eventually producing a bias. At that point, the hypothesis of fairness would be falsified.

Thus, the coin example vividly demonstrates the central principle of *Impossible Probability*: that **all empirical hypotheses are subject to provisional acceptance only**, grounded in statistical reliability and bounded by the temporal fragility of knowledge. ***What is rationally accepted today may, under the passage of time or the accumulation of new evidence, inevitably be overturned.***

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20. The Dialectic of Critical Reason: The Syllogism of Tendency

The mathematical foundation of knowledge lies in the identification of quantitative differences, which, once recognized, manifest themselves in the immediate and observable reality as qualitative differences. This transformation from quantity into quality constitutes one of the cornerstones of dialectical reasoning and provides the logical structure for understanding change and differentiation in both natural and social phenomena [and now we need to include technological phenomena].

20.1. Quantitative and Qualitative Difference

From a dialectical perspective, what differentiates one thing from any other is precisely what grants it its unique essence—its “reason for being” as a distinct entity. This distinction exists even when two things might appear quantitatively identical. If we consider two objects that share the same measurable characteristics, they may seem equal in quantitative terms. Yet, by the very fact of being two rather than one, they are already qualitatively distinct. In other words, identity does not eliminate differentiation at the level of being two different things; numerical duplication itself becomes a marker

of difference. Thus, quantity and quality are inseparably intertwined, and the recognition of this relationship is essential for a critical rational understanding of reality.

René Descartes placed enormous importance on what he termed **"clear and distinct ideas"** (*ideae clarae et distinctae*) as the foundation of rational knowledge. For him, rationalism depended not simply on possessing ideas but on recognizing their clarity and distinctness, since only those ideas could serve as indubitable foundations for further reasoning. A "clear" idea is one that is present and manifest to the attentive mind—something that cannot be obscured by confusion or vagueness. A "distinct" idea is one that is not only clear but also sharply separated from all other ideas, carrying within itself the features that make it self-evident and resistant to doubt.

If we have two objects, as long as they are two, even if they are identical, and from our perception our mind is able to register two different things, it does not matter how identical they are, because they are in fact two different things, clearly and distinguishable. This is the foundation of rationalism, and this is the foundation of Hegelian dialectics. It is not possible to understand Hegel if we do not understand Descartes.

20.2. Hegel and the Principle of Contradiction

When Hegel asserted that *A is not equal to A* ("A ≠ A"), he appeared to break with the classical Aristotelian principle of non-contradiction, which had dominated Western logic for centuries. However, what Hegel was highlighting is the internal dialectic of identity: the first *A* is an entity in itself (*an sich*), and precisely by being *this* entity, it

cannot be exactly the same as the second *A*. The first is the "first," and the second is the "second"; their very sequencing introduces difference, even if they appear identical in content. The moment they are juxtaposed, the result is not one but two—*A + A = 2*, not *1*. The identity of each element is preserved, but difference emerges from their relation.

This insight lays the groundwork for what would later evolve into non-linear and chaotic models, where identity is never absolute but always mediated by relation, temporality, and transformation. By positing that "A ≠ A," Hegel not only challenged classical linear logic but also opened the door to a logic of becoming, where entities are defined not solely by their fixed properties but also by their relation to others and to themselves over time.

[Let me be clear, If an Egyptian potter on the banks of the Nile makes two clay jars, even if they are exactly the same, they clearly are still two different clay jars. If we understand this simple example, we understand how close Descartes and Hegel are]

20.3. Relation with Parmenides

To fully understand Hegel's dialectics, it is helpful to revisit the *Parmenides*, a text whose authorship remains disputed. While many scholars attribute it to Plato, stylistic differences from his other dialogues have led some to question this attribution. Regardless of its origin, the *Parmenides* provides a crucial precedent for dialectical reasoning. It explores the paradoxes of being and non-being, identity and difference, unity and multiplicity—issues that directly prefigure Hegel's more developed system.

Hegel's move beyond classical metaphysics can thus be seen as a continuation of a long philosophical tradition that problematized identity and difference, tracing back to the Eleatic school. The question of whether one and the same thing can both be and not be, or whether identity must always imply difference, is central both to the *Parmenides* and to Hegel's dialectical method.

20.4. A May Be B: The Identity of Opposites

It is from this apparently simple reasoning that the entire structure of dialectics can be understood. If *A* does not necessarily have to be identical to *A*, it follows that *A* might, under certain conditions, be equal to *B*. This insight constitutes the logical seed from which both idealist and materialist dialectics emerge.

Here, the principle of contradiction is no longer a barrier to reasoning but rather the driving force of thought. The transformation of quantitative differences into qualitative changes, the identity of what seems opposed, and the recognition that opposites define and generate one another—all these form the basis of dialectical logic. The possibility that *A* may become *B* illustrates the dynamic nature of reality: entities are not static but processes in motion, tending toward transformation.

This dialectical principle transcends abstract speculation and applies directly to scientific inquiry, social analysis, and epistemology itself. It is the recognition that stability is always provisional, that identity is constructed within difference, and that knowledge must remain open to the continuous interplay of opposites.

[If our potter on the banks of the Nile makes two identical clay jars, A = A, then insofar as they are two distinct jars, the first jar A is equal to the second jar B. As we said before, Descartes and Hegel are two identical philosophers, therefore, they are different, and even, we can say, they are opposites]

20.5. Measurement of Differences and Transformations

Since *A* and *A* are not a single entity but two distinct ones, their difference becomes not only conceptually relevant but also measurable and observable. Once difference is recognized as something perceptible, it becomes subject to quantification. This opens the possibility that, at a critical juncture, what was initially understood as *A* may no longer remain *A* but transform into *B*. Such ***transformation occurs when a series of qualitative changes accumulate and give rise to a quantitative shift, ultimately altering the very identity of the entity in question.***

This dialectical movement illustrates the principle that entities are not static but subject to continuous transformation. The ***identity*** of a thing is never eternal; rather, it **depends on its conditions**, its relations, and the quantitative thresholds that, ***once surpassed, reconfigure its qualitative character***. Thus, measurement becomes an essential tool in dialectical reasoning, as it enables the detection of the precise point at which continuity becomes discontinuity—when an entity ***ceases to be what it was and becomes something new.***

20.6. The Quantitative Problem and Critical Reason

The central problem, therefore, is a quantitative one: how do we determine when *A* is still *A* and not yet *B*? Or conversely, when has *A* ceased to be itself and transformed into *B*? This is not merely a question of perception but a mathematical and logical problem.

Only through critical reason—that is, a rational criterion capable of defining thresholds, proportions, and margins of error—can such determinations be made. ***Critical reason*** functions as the intellectual instrument that allows us to distinguish between apparent and substantive change, between superficial variation and true transformation. In doing so, it bridges the gap between mathematics and philosophy, between empirical observation and rational judgment.

20.7. Astronomical Example of Critical Differentiation

To illustrate this, let us consider the example of stars. Mathematically and empirically, we can classify stars as small, medium, or large depending on measurable variables such as size, volume, mass, and density. By analyzing size and volume, we can establish the thresholds that define a small, medium, or large star. Mass, in turn, gives us an approximate measure of gravitational force, which influences the capacity of a star to sustain a solar system with orbiting planets.

From there, the classification extends: the types of planets orbiting a star, their potential to develop satellite systems, and the broader structure of galaxies determined by the number and type of stars they contain. Further, by comparing the dimensions of

galaxies and their relative distances, we can hypothesize about the conditions necessary for the existence of life. Such hypotheses may even explore whether bioregenerative processes could render certain planets habitable, whether natural resources could be exploited, and whether interstellar travel to those planets would be feasible.

In each step, the process involves applying quantitative thresholds to qualitative classifications. A star is not only "a star"; its essence is redefined through measurement, which allows us to differentiate, compare, and generate new knowledge about its potential role in the cosmos.

20.8. Definition of Critical Reason

What we are ultimately doing in these analyses is employing critical reason. By "*critical reason*" we mean the rational criterion by which logical differentiations are established in reality for the purpose of constructing adequate knowledge. Critical reason provides the framework that allows us to discern *when a quantitative measure signifies a real qualitative distinction* and when it does not.

In this sense, critical reason is not merely a theoretical abstraction but an operational tool that underlies both scientific inquiry and philosophical reflection. It sets the boundaries of rationality by determining when an entity must be classified as one thing rather than another, and it establishes the conditions under which transformation can be said to occur. *Without critical reason, differentiation collapses into relativism*; with it, knowledge gains both rigor and coherence.

[*20.8.1. Postmodernity and Impossible Probability*

The importance of this passage 20.8 lies in the fact that it represents one of the very few moments in Impossible Probability where relativism is directly criticized. While it is clear that rationalism is not the same as relativism, the general strategy of this work has never been to engage in polemics with competing theories, but rather to remain focused on building its own conceptual framework. Nonetheless, it is essential to underscore this point: Impossible Probability does not endorse relativism.

This distinction matters because the project is oriented toward accelerating the transition to a post-industrial society shaped by the emergence of a post-human world. In this context, relativism—which dissolves truth into multiple, incommensurable perspectives—cannot provide the epistemological grounding necessary for an artificial intelligence capable of universal reasoning. By contrast, the framework of Impossible Probability is rooted in rationalism, which insists on the possibility of clear, distinct, and non-relative criteria for knowledge.

At the same time, it is important to note that this rationalist foundation is not opposed to the historical condition of postmodernity but rather embedded within it. Indeed, one of the central premises of my doctoral research has been that we already live in a postmodern society, a society whose defining characteristics are shaped by globalization. In this sense, Impossible Probability can be understood as a non-relativist theory developed inside a postmodern world, anticipating the conditions of a globalized artificial intelligence.

Thus, while refusing relativism, the framework remains situated in the "logic of the post": post-industrial, post-human, and postmodern. What it offers is not a return to

pre-modern absolutes, but the articulation of a non-relativist rationalism adequate to the realities of an AI-driven globalization.]

20.9. Magnitudes as a Rational Criterion

If we declare that, up to a certain magnitude, a star is classified as small, medium, or large, then any star whose measurements fall at or below that magnitude will be defined accordingly. In this way, a rational criterion has been established to describe reality. What is at stake here is the determination of the threshold—the rationally logical magnitude—at which quantitative differences become sufficient to generate qualitative differences.

This principle illustrates the crucial role of measurement and classification in both science and philosophy. By assigning categories through magnitude, we create logical boundaries within which phenomena are organized. These thresholds are not arbitrary; they are constructed to provide a coherent framework that reflects the relationship between observable reality and rational differentiation. Without such thresholds, it would be impossible to establish the conditions under which one state of being shifts into another. Thus, magnitudes serve as the rational hinge between continuity and transformation.

20.10. The Problem of Unity in Mathematics

One of the most fundamental and problematic issues in mathematics is the meaning of “unity” or the number one [as we said, Parmenides plays a key role in dialectics].

What does it mean to say that there is “one”? The term *unity* may refer to the absence of plurality, a self-contained existence, an entity in and of itself, a singular and indivisible “one.” Alternatively, unity can also mean the unity of plurality: a collection of different elements that together constitute a whole.

This duality exposes the ambiguity of “one” as both a singularity and a synthesis. On the one hand, “one” suggests pure identity and indivisibility. On the other hand, “one” may equally signify the totality of multiple parts forming a unified structure. This ambiguity, far from being a trivial linguistic issue, opens profound philosophical and mathematical debates about the foundations of number, being, and reality itself.

20.11. Unity as the Indivisible

The first conception—that unity is an indivisible one, hermetically sealed and incapable of internal subdivision—is philosophically powerful but empirically problematic. Even in physics, no absolutely indivisible “original particle” has been definitively confirmed. Every known subatomic structure appears divisible into further components, with the partial exception of the Higgs boson , whose exact role remains under investigation. If such a particle exists as truly indivisible, it would provide the empirical foundation for the concept of absolute unity. Yet at present, the idea of a perfectly indivisible entity remains more conceptual than real.

This interpretation frames unity as an absolute, a one that exists by itself without any plurality. However, in empirical reality, such pure unity has not been observed. Thus, the

indivisible one functions more as a theoretical construct, a metaphysical idea that helps guide reasoning, rather than a fully confirmed aspect of material reality.

[This document was written in 2012, Stephen Hawking confirmed the Higgs Boson in 2018, when we were working on GAI, actually, he passed away on the same year 2018]

20.12. Unity as Plurality

The second interpretation conceives unity not as indivisibility but as the unity of plurality. In this sense, what we call “one” is not a hermetic singularity but the result of the interaction and integration of multiple factors. Mathematically, such unity is not a self-contained one but the outcome of an algorithm—an equation or formula that expresses the relationships among different variables.

Under this view, unity is not a pure ontological state but a mathematical or logical construct, representing the synthesis of diverse elements into a coherent whole. What appears as “one” is, in reality, the product of relations, interdependencies, and calculations. Thus, unity becomes not an indivisible essence but a dynamic equation, a proposition that maps how plurality coalesces into an apparent singularity.

20.13. The Human Limit of Knowledge

Qualitatively and rationally, the problem of unity reveals the deeper impossibility of knowing “being-in-itself.” Human reason, by its very nature, does not grasp absolute

reality but only the empirical reality it constructs for itself. What we perceive and systematize through science or philosophy are not the essences of things but their appearances—***phenomena mediated by human categories, senses, and reasoning structures.***

This limitation means that knowledge is always partial, situated, and ***mediated***. The "***thing-in-itself," in the Kantian sense, remains inaccessible***. Critical reason, therefore, does not promise omniscience but instead provides a framework for acknowledging both the power and the limits of human cognition. To recognize this limitation is not a defeat but rather the very condition for meaningful epistemology: we know that we do not know the absolute, and this recognition is the foundation of rational humility.

[One of my dreams while working on GAI from Christmas 2017 until 7 October 2018 was the possibility of building a machine capable of accessing that knowledge restricted to the human condition. In 2025, what I realized is that, while the dream is still valid, there are too many difficulties in reaching pure truth, even for a global AI equipped with Superintelligence. One of the problems, apart from sample size, is the reality that in the case of the global AI, knowledge is still mediated by its own artificial conditions. It is true that these artificial conditions are far superior to the human condition, but they are still conditions that can artificially constrain knowledge. While traditional philosophy maintains that the knowledge of pure truth is impossible, from the perspective of *Impossible Probability* it is just a matter of time, given the right conditions. The point is: what conditions will be necessary to know the truth?]

20.14. Phenomena and Human Limitation

Human beings, by their very nature, cannot know the whole of reality. At best, they can know parts of the whole, fragments of things, never the totality. From any given object, we can only apprehend aspects, never the complete essence. Much less can we hope to grasp all things simultaneously. This inherent limitation reduces human knowledge to the realm of phenomena: appearances structured by our cognitive faculties and accessible through empirical observation and rational construction.

Even as science, philosophy, and dialectical reasoning advance, they remain bound by the rational condition of humanity. This limitation, however, should not be seen as a flaw but as a natural characteristic: what is produced by human beings will always be human in nature. Critical rationalism, positivism, and dialectics all testify to this: knowledge is always human knowledge, constrained by our finitude, but valuable precisely because of its grounded, human origin.

20.15. The Margin of Error and the Unknown A

Once we recognize the impossibility of knowing everything, we also accept the natural origin of error in science. Absolute certainty is unattainable. When we say “A is A,” we assign a name to something we do not truly know in its entirety. We construct complex theories about entities of which we only possess partial knowledge. Consequently, a margin of error is inevitable, built into the very structure of human inquiry.

This acceptance of error is not accidental but essential: it reflects the fact that ignorance and limitation are part of the human condition [what remains to see if it is going to be part as well of the Superintelligence and the global AI]. Since we never fully comprehend what *A* is, it is always possible—within a margin of error—that *A* is not *A* but rather *B* or *C*. Scientific knowledge, therefore, is not the revelation of ultimate truth but the construction of provisional truths, always open to correction and reinterpretation. Error is not a failure of science but a constitutive feature of its critical, self-correcting nature.

20.16. Kant's Antinomy

Kant's logical antinomies demonstrated that two opposing propositions, each rigorously derived from a valid sequence of premises, can both appear equally true. This insight revealed the paradoxical nature of human reason when it ventures beyond phenomena into the realm of metaphysical speculation. Reason, when pressed to its limits, generates contradictions that are not merely errors but necessary products of its own structure.

The significance of this insight lies in its warning: reason cannot claim absolute mastery over reality, for it can generate systems that are internally coherent yet mutually exclusive. In epistemology and science, this points to the necessity of critical vigilance: hypotheses may be well-founded and logically compelling yet stand in direct opposition to others equally well-founded. Thus, contradiction itself becomes a rational phenomenon, not a mere logical mistake, highlighting once again the finite and dialectical character of human knowledge.

20.17. Popper and Hypothesis Testing

In contrast to Kant's antinomy—which would imply that both the empirical hypothesis and the null hypothesis could be simultaneously true—Karl Popper developed a model that redefined the logic of scientific inquiry. For Popper, no hypothesis can ever be definitively verified; rather, a hypothesis remains provisionally valid until it is demonstrated to be false. This is the principle of *falsifiability*, which became central to twentieth-century philosophy of science.

In statistics, this principle corresponds to what is known as *hypothesis testing*. A working hypothesis (the empirical hypothesis) is accepted only provisionally, subject to rigorous attempts at refutation. The null hypothesis functions as its logical counterpoint: it asserts the absence of the proposed effect or relationship. The task of science is then to test whether the empirical data provide sufficient grounds to reject the null hypothesis, thereby giving temporary validity to the empirical one.

This model provides a practical mechanism for resolving the problem of contradictory theories without falling into relativism. Instead of assuming that opposing hypotheses can both be "true," Popperian logic requires that they be tested against reality, with the less adequate one discarded. In this way, scientific progress advances not through accumulation of certainties but through the systematic elimination of falsehoods.

20.18. Impossible Probability and the Critical Tradition

Impossible Probability situates itself within this Popperian and Cartesian tradition of critical rationalism [from our point of view Marx and Engels should be included in the critical traditional even when they were materialists, they were the first authors explaining the value of ideology and politics in science]. Like Descartes' insistence on methodological doubt and Popper's demand for falsifiability, it maintains that contradictory propositions cannot simultaneously explain the same reality. If *A* and *not-A* are posited as explanations for the same phenomenon, one of them must necessarily be false.

This stance emphasizes the need for rigorous rational criteria to evaluate hypotheses. Reality cannot be coherently explained by two mutually exclusive theories at the same time. Thus, *Impossible Probability* rejects the relativist temptation to treat all hypotheses as equally valid. Instead, it insists that rational demonstration must establish which explanations are more consistent with empirical evidence, while recognizing that even the best explanation remains provisional, subject to further testing and revision.

20.19. Exclusion of Opposing Theories

If an empirical model generates two opposed theoretical explanations, it necessarily follows that one of them must be absolutely false. Two mutually contradictory

theoretical models cannot both explain the same empirical reality. This principle reinforces the rationalist demand for logical coherence in scientific explanation.

The existence of competing theories, of course, is common in science. But the dialectical process requires that these theories be subjected to rational and empirical testing, with the recognition that only one can provide a coherent account of the observed phenomena. This does not deny the provisional character of knowledge—today's "true" theory may later be disproven—but it does reject the simultaneous acceptance of direct contradictions as equally valid descriptions of reality.

20.20. Human Limitation and Relative Reliability

At the same time, it must be acknowledged that every empirical hypothesis, even when accepted as rational and more reliable than its alternatives, is never absolutely certain. This derives from the Cartesian recognition of doubt as a permanent horizon: no human proposition is exempt from the limitations of human reason.

Thus, any hypothesis is necessarily subject to a margin of error. This margin does not simply reflect methodological shortcomings but the deeper condition of human finitude: the impossibility of knowing the whole of reality or the thing-in-itself. In this limitation lies the very essence of critical reason: it provides a logical framework for deciding what is "more real" without claiming to access ultimate reality itself.

Critical reason, therefore, operates within the tension between reliability and fallibility. It seeks to distinguish between better and worse explanations, to identify patterns, tendencies, and structures in empirical reality, while always maintaining the awareness

that its conclusions are provisional. Reliability is always relative, and certainty is never absolute.

20.21. Reality-in-Itself as Unknowable

Reality-in-itself is, from a rational standpoint, fundamentally unknowable. What human beings access are not essences but *phenomena*—appearances filtered through perception, cognition, and rational categories. Science organizes these phenomena into coherent syntheses, constructing explanatory frameworks that allow us to manipulate, predict, and systematize reality. Yet what lies beyond this synthesis—the "reality outside itself"—remains inaccessible.

Beyond science, there exists only metaphysics, which by definition lacks sufficient reliability because it seeks to grasp what transcends the conditions of human knowledge. While metaphysics can inspire speculative insights, it cannot establish certainty. Critical rationalism thus positions itself within the boundaries of what can be known: the realm of phenomena. To accept the unknowability of reality-in-itself is to affirm both the strength and the humility of reason.

[In social theory, it is quite interesting how Adorno attempted to create a Marxist metaphysics, although his attempt was not very successful. While there are still some thinkers trying to remake metaphysics and adapt it to our postmodern times, the truth is that metaphysics had its time during classical antiquity and Christian thought. In the same way that we can say all philosophy after Kant is post-Kantian or neo-kantian philosophy, we can also apply this to Auguste Comte: all philosophy after Comte can

only be post-positivist or neopositivist, Marxism included (we cannot understand socialism without ***Henri de Saint Simon***).]

20.22. Critical Reason as a Logical Criterion

Critical reason, in this context, functions as the logical and rational criterion by which categories are established to define reality. It is not a metaphysical guarantee of truth but an operational method for distinguishing what is more coherent, more consistent, and more reliable within the horizon of phenomena.

Through critical reason, we construct the categories—such as magnitude, difference, identity, and transformation—that allow us to make sense of empirical reality. These categories are not arbitrary: they embody rational necessity while remaining open to revision as knowledge advances. In this sense, critical reason is both constructive and self-critical, the very mechanism by which human thought advances without overstepping into dogmatism.

20.23. Reality as Dialectical Transformation

We only study differences and changes, both quantitative and qualitative. From the standpoint of dialectics, reality is pure transformation: nothing remains fixed, everything is in motion. The permanence of things is only apparent, a temporary stability within an ongoing process of becoming.

Reality, then, is dynamic, volatile, and ceaselessly mobile. The dialectical perspective insists that identity is inseparable from change, that every entity contains within itself

the seeds of transformation. To grasp reality critically is to accept it as process, not as static being. This understanding places transformation at the very heart of rational and scientific inquiry.

[When I was doing my PhD, I had to study ***Jullien de Paris***, the founder of comparative education, and at some point I realized that, in fact, all science is a comparative study: we can only know what is clearly and distinguishably different (Descartes).]

20.24. Statistics of Tendencies

From the perspective of statistics, what we study are essentially *tendencies*: the observed directions in which phenomena move. To determine what is happening, we establish criteria—thresholds and measures—by which to evaluate whether an observed change is sufficient or insufficient to be considered determinant.

Yet, even here, determinism must be rejected. Nothing absolutely determines anything else, for behind the appearance of an "absolute whole" lies an irreducible uncertainty. Reality-in-itself remains unknowable, and in the infinite horizon of being, the most probable outcome is that everything tends toward zero. This dialectical insight culminates in the paradox that, within the absolute infinity, all being ultimately reveals itself as an infinite absolute nothingness.

This does not negate the utility of statistical analysis but situates it within a deeper philosophical framework: tendencies describe phenomena provisionally, while the ultimate ground of reality remains beyond rational capture.

20.25. The Syllogism of Tendency

Within this framework, the *syllogism of tendency* emerges as a methodological tool of *Impossible Probability*. Its aim is to study the changes that occur in things in order to determine their ***identity or transformation***. The syllogism asks: under what conditions is something *A*, or *not-A*? When does something cease to be *A* and become *B*? Or, under what transformations might something ultimately be classified as *C* or *not-C*?

The syllogism of tendency therefore provides a logical structure for analyzing processes of change. It does not simply affirm static identities but investigates how tendencies toward transformation alter the meaning of identity itself. It is a bridge between logic, dialectics, and statistics, applying rational criteria to the shifting phenomena of reality.

20.26. Uncertainty in the Identity of A, B, and C

Of all that happens, we never possess absolute certainty that *A* truly is *A*. Even when, within a given margin of error, we affirm that *A is A*, it remains possible that *A* is in fact *not-A*, or that it is *B* or *C*. Likewise, *B* may be *not-B*, or transform into *A* or *C*; and *C* may be *not-C*, or tend toward *A* or *B*.

This illustrates the principle of epistemic uncertainty inherent to all rational inquiry. Identities are never guaranteed; they are provisional classifications subject to revision in light of tendencies and transformations. Knowledge thus operates within probability, never absolute certainty. What the syllogism of tendency captures is precisely this dynamic of uncertainty: that identities are

always at risk of becoming something else, and that rational critique must remain alert to these potential transformations.

20.27. The Dynamics of Transformations

In a dynamic model, where *A* is initially defined as *A* and *B* as *B*, it may turn out that the natural tendency of *A* is to cease being itself (*not-A*) in order to become *B*. Once *A* has become *B*, the tendency of *B* may then be to cease being *B* (*not-B*) in order to become *C*. In this way, the true trajectory of **A may reveal itself** not as remaining static but as tending toward *B* and eventually into *C*.

Thus, at the conclusion of the process, we may affirm that ***A is C***. This is not merely a linguistic substitution but a real ***transformation***: what began as *A* has undergone a dialectical progression, passing through negation and mediation, until it emerges as something qualitatively different. This illustrates the dialectical law of transformation, where identity is never permanent but continuously redefined by tendencies and processes of becoming.

20.28. Theoretical Construction of A, B, and C

To determine whether something is *A*, *B*, or *C*, it is first necessary to construct *theoretical definitions* of what these categories mean. *Without such prior construction, the act of classification is meaningless*. This construction requires once again the application of critical reason, which establishes the rational magnitudes and thresholds by which distinctions are made.

For example, we may define that any entity equal to or below a certain magnitude qualifies as *A*, while those that surpass this magnitude qualify as *B* or *C*. These magnitudes function as rational boundaries that allow us to identify when quantitative variation produces qualitative transformation. In essence, this is the critical rational method proposed by *Impossible Probability*: to define entities not arbitrarily but through reasoned, measurable criteria that allow for logical and empirical differentiation.

20.29. The Insecurity of Statistical Knowledge

Absolute certainty about what a thing is can never be attained. At most, statistical reasoning allows us to describe tendencies: whether a given entity tends to remain itself, to dissolve into nothing, or to become something different from itself. Sometimes, what is observed is a tendency toward identity; at other times, it is a tendency toward transformation or even self-negation.

The paradox arises that an entity may appear identical to anything else except itself. This underscores the precariousness of knowledge: ***categories are always provisional***, definitions always ***contingent***. Statistical knowledge is ***powerful*** because it captures tendencies, but it is insecure because those tendencies are never absolute. Thus, insecurity is not an accidental defect but a structural feature of knowledge when confronted with an ***ever-changing reality***.

20.30. The Rational Critique of Tendency

Within this framework, the *syllogism of tendency*—as developed in the method of *Impossible Probability*—finds its principal object: the rational critique of tendencies. **The task is to study whether a given tendency is sufficient to establish identity, to signify nothingness, or to generate a transformation profound enough to constitute a qualitative leap in history.**

This critique asks: when does a change become sufficient to count as transformation? When does persistence become dissolution? When does continuity become rupture? The rational critique of tendency thus becomes the key to understanding not only scientific and statistical processes *but also the unfolding of historical and existential change*. It seeks to measure *the sufficiency of transformation*, distinguishing between superficial variation and those shifts that mark decisive thresholds in the becoming of reality.

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